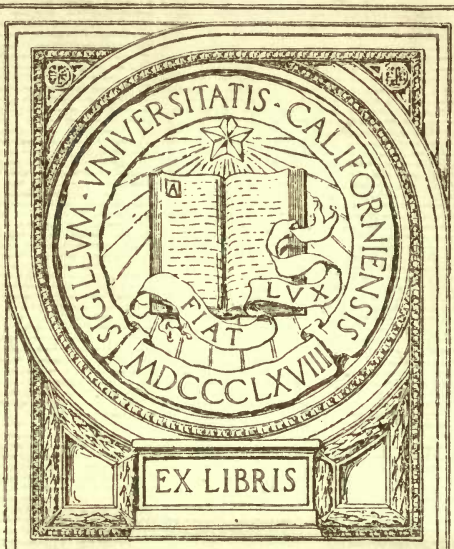
IN MEMORIAM
Irving Stringham



Math. Dept.

Rev. Mr. Day
with the regards
of Fred Buck
Class of 36

UNIV. OF CALIFORNIA

NA HAAWINA MUA

O KA

HOAILONA HELU,

A ME

KA ANAHONUA,

KA ANAHUINAKOLU,

KA ANA AINA,

A ME KE

KUMU HOLOHOLOMOKU.

LAHAINALUNA.

1843.

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Grad. Dept.

2.m
Irving Stringham
Math. Dept.

UNIV. OF CALIFORNIA

KA HOAILONA HELU.

MOKUNA I.

KA MEA HOAKAKA.

PAUKU I.

Na Hoailona a me na Hoonui.

1. Kuai kekahi keiki i ka ohia a me ka alani i na keneta he 12, no ia mau mea. Ua oi pakolu hoi na keneta o ka alani imua o ko ka ohia. Ehia na keneta o kela a o keia?

E kau iho i ka *w* i hoailona no na keneta o ka ohia. A o ka *w* ke kumukuai i ka ohia, a he pakolu ko ka alani i ko ka ohia; nolaila, he mau *w* ekolu ke kumukuai i ka alani. He *w* hookahi ko ka ohia, a he akolu mau *w* ko ka alani, ina e huia lakou, he mau *w* eha o ka huina. Aka, he 12 na keneta i lilo no ia mau mea a elua, nolaila, ua like na *w* eha me ia mau keneta he 12. A, ina he like na *w* eha me ka 12, alaila, ua like ka *w* kookahi me ka hapaha o ka 12, oia 3 mau keneta. O ka *w* ka hoailona o na keneta kuai i ka ohia, nolaila, ua make ka ohia i na keneta 3. Ina i make ka ohia i 3 keneta, ua pakolu na keneta i make ai ka alani, oia 3 ekolu keneta. Nolaila, he 9 na keneta ke kumukuai i ka alani.

Ma keia hana ana, ua kauia ka *w* i hoailona no ka mea i *ike ole ia;* oia no na keneta o ka ohia, a o ka alani. E hiki pono no ka mea e ae i hoailona. Aka, ma keia

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helu, he mau no ke kakau i na hua hope o ka Pia-pa, i *m*, *n*, a me ka *w*, i hoailona no na mea i *ike ole ia;* a e hoailona hoi i na mea i *ikeia* ma na hua mua o ka Pia-pa, o *a*, *e*, *i*, a pela aku.

2. Ua oi pa 4 aku na makahiki o Ioane imua o ko Iakobo; a o ka huina o ko laua mau makahiki, he 20 ia. Ehia na makahiki o kela, o keia?

E hoailona i na makahiki o Iakobo i ka *w*, no ka mea, he pa 4 na makahiki o Ioane i ko Iakobo, 4 mau *w* ka hoailona o kona mau makahiki. Nolaila, hookahi *w* a me 4 *w*, oia no 5 *w* ka huina o ko laua mau makahiki. Aka, he 20 ka huina o ko laua mau makahiki; nolaila, ua like 5 *w* me ka 20, a o ka *w* hookahi me ka hapa 5 o ka 20, oia na makahiki 4; oia ko Iakobo mau makahiki. Ina hoi ua like ka *w* hookahi me ka 4, alaila, ua like na *w* 4 me ka 16, oia no na makahiki o Ioane.

Aole kakou e kakau hookahi *w*, elua *w*, ekolu *w*, aka, e kakau no i ka huahelu mamua o ka hoailona; penei, he *w*, 2 *w*, 3 *w*, 4 *w*, a pela aku. Ua kapaia na hua helu imua o ka *w*, he *heluna*. Ina aole i kauia ka heluna imua o ka hua, hookahi wale no ia; penei, he *w*, a 1 *w*, ua like pu no laua.

I ka hana ana i ko ka ui 2, ka hoailona no na makahiki o Ioane, 4 *w* ia. A i ka loaa ana o kona makahiki, ua hoonuiia ka *w* me ka 4, 4 *w*. Nolaila, *o na hoailona a pau, e kau ana ka heluna mamua ona, ua hoonuiia ua hoailona la i kona heluna.* Penei, ina e hoailonaia ke 6 i ka *w*, alaila 3 *w*, 3 ono ia, oia he 18; ina hoailonaia ka 10 i ka *w*, alaila 3 *w*, 3 ia 10, oia he 30; a 7 *w*, he 70 ia; 9 *w* hoi, he 90.

He mea pono no hoi ma keia helu ke kau i kekahi hua *a* i heluna, imua o ka hoailona *w*, penei, *a w*, a ua lilo ka *a* i heluna no ka *w*. A ina he hoailona ka *a* no ke 3, a o ka *w*, 5 ia, alaila o ka *a w*, 5 kolu ia, oia he 15.

3. I ka hele ana o A mai Honolulu aku a Ewa, 3 na mile o kona hele ana i ka hora 1. Ia manawa hookahi no,

ua haalele o E ia Waialua i kona hele ana i Ewa, 5 mau mile o kona hele ana i ka hora 1. He 32 na mile mai Honolulu a Waialua. Ehia na hora e hele ai laua a halawai ma Ewa?

Ma keia hana ana, o na hora hele o laua ka mea imi. E hoailona i na hora i ka *w*. A halawai laua i ka *w* hora. Ina e hele o A i 3 mile i ka hora 1, e hele no hoi oia i 3 *w* mile i ka *w* hora; ina hoi e hele o E i 5 mile i ka hora 1, e hele no hoi oia i 5 *w* mile i ka *w* hora. A e hele laua a elua i 3 *w* a me 5 *w* mile, oia 8 *w* mile ia manawa. Aka, o ka 8 *w* mile, oia na mile mai Honolulu aku a Waialua. Nolaila, ua like ka 8 *w* me ke 32, na mile o ka loa. Ina hoi, ua like ka 8 *w* me ke 32, alaila ua like ka *w* hookahi me ka hapa 8 o ke 32, oia hoi 4. Nolaila, e halawai no laua i na hora 4.

Ina e kakauia 3 *w* penei, *w* 3, aole i loleia ke ano, ua like no laua. No ka mea, *ina i kakau pu ia na hua elua, aole mea hookaawale mawaena, ua hoonuiia kekahi e kekahi.* Ina 4 ka mea i hoailonaia e ka *w*, ma ke 3 *w*, alaila o ke 3 *w*, ua like ia me na 4 ekolu, oia he 12, a pela hoi ka *w* 3, he akolu ia 4, oia ka 12. E aho hoi ke kakauia ka hua helu mamua o ka *w*.

4. Kuai kekahi i ka bipikeiki, i ka hipa, a me ka hoki, a loaa mai na dala he 36. Ua palua ke kumukuai no ka hipa imua o ko ka bipikeiki; a ua pakolu ko ka hoki kumukuai imua o ko ka hipa laua o ka bipikeiki. Ehia na dala i make ai o kela a me keia a pau?

He *w* ka hoailona no ka bipikeiki; alaila, 2 *w* ko ka hipa; o *w* a me 2 *w*, oia 3 *w*, ke kumukuai no laua a elua. A ekolu 3 *w*, oia 9 *w*, ke kumukuai o ka hoki. O keia mau holoholona ekolu, ua kuaiia lakou i ka *w*, me 2 *w*, a me 9 *w*, oia ka 12 *w*. O na dala a pau o lakou, he 36 ia; nolaila, ua like ka 12 *w* me ke 36, a o ka *w* hookahi, he hapa 12 ia o ke 36, oia hoi 3 mau dala. Nolaila, 3 mau dala ke kumukuai o ka bipikeiki. Ina ua like ka *w* me 3 dala, alaila ua like 2 *w* me na dala 6, ko ka hipa ku-

mukuai; a o ka 9 *w* 9 kolu dala ia, oia he 27 na dala ke kumukuai i ka hoki.

5. Puunaue aku la kekahi i ka puu dala na na keiki ana ekolu, penei, e palua ka Maria mau dala i ko Elena, a e like ka Ioane puu me ko na kaikuwahine ona a elua. Ehia na dala o kela mea keia mea?

No ka mea, aole i haiia mai ka nui o na dala, e hoailonaia na dala i ka *a*.

He *w* ka hoailona no na dala o Elena, alaila 2 *w* ka hoailona no ko Maria; a o ko Ioane he *w* a me 2 *w*, oia 3 *w*; a o ka huina o ko lakou mau puu, he *w*, 2 *w*, a me 3 *w*, oia no 6 *w*: a ua like ia me ka *a* ka puu okoa. Ina e like 6 *w* me ka *a*, alaila ua like ka *w* me ka hapa 6 o ka *a*, oia no ka puu ia Elena.

Ina he 18 ka puu dala okoa, 3 na dala no Elena, 6 no Maria, a 9 no Iaone.

Ina he 24 ka puu dala okoa, alaila no Elena na dala 4, no Maria 8, a no Ioane he 12.

Pela e ikeia'i ka puu dala no lakou a pau, ina he nui a he uuku paha ka puu dala i hoailonaia e ka *a*.

He mea hoikeike keia mokuna i ke ano o ka Hoailona Helu, a me ka loaa ana i na mea i ike ole ia ma keia hana.

PAUKU II.

Na Kaha o ka Hoailona Helu.

Aole o na hua *a* wale no na hoailona o keia helu, he mau kaha no hoi kekahi. He mau mea lakou e kokua ai i ka hana ana i na ui o ka Hoailona Helu. He mau mea hoi lakou e hoopokoleai, a e hoakaka hoi i ka hanaa na i na hana loihi akaka ole.

+ *(He hui.)* Ke hoike mai nei ia kaha i ka *Houluulu;* penei, 4 + 5, 9 ia. Penei ka heluhelu ana, 4 a hui aku i 5, 9 ia; a penei hoi, 4 me ka 5, 9 ia.

Pela hoi keia mau hua, $m + w$, hoike mai no ke kaha $+$ e huipuia ka m me ka w. Ina e hoailonaia ke 6 i ka m, a o ka 4 i ka w, alaila e like ka $m + w$ me ke $6 + 4$, oia ka 10.

— *(Emi.)* O ke kaha — i kauia imua o kekahi hua, ua hoike mai no ia, e unuhiia'e ua hua la mailoko mai o ka hua e kau ana mamua o ke kaha; penei, $9 - 6$ 3 koe, ua heluheluia oia, 9 emi iho 6 3 koe, a eia hoi, he 9 a lawe 6 3 koe. O ke ano no, ina i laweia ke 6 mailoko ae o ka 9, 3 no ke koena.

Pela hoi ma ka hoailona $m - w$, ua unuhiia ka w mailoko ae o ka m. Ina he 12 ka m, a 7 hoi ka w, alaila ua like ka $m - w$ me ka $12 - 7$ oia 5 koe.

O na kaha $+$ a me ka —, ua pili laua me na hua e kau ana ma ko laua akau wale no. Nolaila, o keia mau hua,

$$9 + 6 + 5 - 7$$
$$9 + 6 - 7 + 5$$
$$9 - 7 + 6 + 5$$

ua like wale no ko lakou huina, no ka mea, he 13 ka huina o kela a me keia a pau. Ina aole i kauia ke kaha mamua o ka hua mua o kekahi lalani huahelu, o ka $+$ ka mea maopopo ma ke ano.

$=$ O keia mau kaha kau like, ua kapaia *he like*, a ke hoike mai nei no ia i ka like ana o kekahi mea me kekahi mea, penei, $3 + 4 = 9 - 2$; (penei ka heluhelu ana, 3 i huiia me ka 4, ua like ia me ka 9 lawe 2.) Ina he $m + n = w$, ua ike kakou he like ke ano o ka w me ke ano o ka m i huipuia me ka n. Nolaila, ina he 6 ke ano o ka m, a 4 ke ano o ka n, alaila, no ka hui ana o laua i ka $+$, ua like ka w me ka 10.

$\times$ *He kaha hoonui keia;* penei, $3 \times 4 = 12$, (3 i hoonuiia i ka 4, ua like ia me ka 12.) Ua waiho pinepine ia keia kaha ma ke kakau ana i na hoailona, penei, $m\,n$, no ka mea, oia ka loaa ana o ka m i hoonuiia i ka n. Nolaila, ina $m = 5$, a o ka $n = 3$, alaila $m\,n = 15$, no

ka mea, $3 \times 5 = 15$. Aka, aole i kauia ua kaha $\times$ la mawaena o na huahelu i hoonui pu ia.

$\div$ *(He kaha puunaue.)* Ua hoike mai keia kaha e puunaueia ana ka mea mamua ma ka hema o ke kaha, i ka mea mahope ma kona akau; penei, $12 \div 4 = 3$, oia hoi keia 12 i puunaueia e ka 4, ua like me ke kolu. Aka, ua kakauia hoi ka puunaue ma ke ano o ka hakina, penei, $\frac{12}{4} = 3$, a e heluheluia oia e like mamua.

Pela hoi $m \div n$, a eia hoi, $\frac{m}{n}$, ua hoike mai no ia i ka m i puunueia e ka n. Nolaila, ina $m = 10$, a o ka $n = 2$, alaila $\frac{m}{n} = 5$, no ka mea $\frac{10}{2} = 5$.

He kaula —— i kauia maluna o kekahi mau mea, *i huipuia'i ia mau mea i hookahi.* Penei, $4 \times \overline{a + e}$, o ke ano no, ua hoonuiia ka huina o ka $a + e$ i ka 4. Ina ka $a = 5$, a o ka $e = 6$, alaila,

$$4 \times \overline{5 + 6} = 44;$$

no ka mea, $5 + 6 = 11$, a $4 \times 11 = 44$.

Eia hou, $\overline{a + e} \times \overline{m + n}$: maanei e hoonuiia ka huina o ka $a + e$ me ka huina o ka $m + n$. Ina o ka $a = 2$, a o ka $e = 3$, a o ka $m = 4$, a o ka $n = 5$; alaila,

$$\overline{2 + 3} \times \overline{4 + 5} = 5 \times 9, \text{ oia he } 45.$$

O ke *apowaena* ( ) ua like kona ano me ko ke kaula, e hoohui pu i na hua okoa i hookahi ma ka hana ana. Penei, $3\ (m + w)$ ua hoike mai ia, e pakoluia ka huina o ka $m + w$. Ina o ka $m = 6$, a o ka $w = 4$, alaila,

$$3\ (m + w) = 3\ (6 + 4) = 3 \times 10, \text{ oia he } 30.$$

O na mea i huipuia i ke kaula, a i ke apowaena paha, e hanaia lakou e like me ka hua hookahi, a o ka hua e kau ana ma kona hema, oia kona heluna.

PAUKU III.

No ka mea kahi, ka mea hui, na mea ano like, na mea io, a me na mea io ole.

O ka *mea kahi*, he hua hookahi ia, a he mau hua hoi e kau pu ana me ka hui ole ia i ke kaha + aole hoi i ka —; penei, *w*, 3 *m*, *a e i*, a me keia paha *m w*, he mau mea kahi lakou.

O ka *mea hui*, he mau mea kahi ia i huipuia i kekahi o na kaha elua, o keia + a o keia paha —; penei, *n* + *w*, *a* — *e* + 3 *i*, *a e* — 7 + *w* — 8 *m*; he mau *mea hui* o kela a me keia a pau.

Ina he alua wale no hua o ke kahi mea hui, ua kapaia oia he *hua kaulua*, penei, *m* + *n*, *a* — *e*, a o keia hua kaulua hope, o (*a* — *e*) ua kapaia hoi oia, he *kaulua mea koena*, no ka mea, ua hoike mai no ia i ke koena oloko ona, mahope o ka unuhi ana.

O na *mea ano like*, he hua hoailona like ko lakou, a he okoa wale no ma na heluna, a ma na kaha paha. Penei, 3 *a*, me 5 *a*, he mau mea ano like laua; pela hoi, 3 *m w*, a me 7 *m w*; eia hoi, 2 *a e*, a me — 8 *a e*; a me keia mau mea hui, 3 *a e* + 4 *w*, a me 5 *a e* — 9 *w*.

O na mea hana a pau i kakauia ma keia helu, ua kapaia lakou he *mea io*, a *he mea io ole*.

O ka mea io, ua kauia ke kaha + mamua ona; a o kona ano, he mea ia e huiia'ku ai. Aka, ina e ku kaawale ka mea io, me he *w* la, a i ku paha he hua mua o na mea hui, penei, *a* + *e*, aole i kakauia ke kaha + imua ona. Nolaila, ua like ke ano o ka *w* wale no me ka + *w*, a o ka *a* + *e*, ua like ia me ka + *a* + *e*.

O ka *mea io ole*, oia ka mea *e unuhiia'i noloko o ka mea io*, a e kauia hoi ke kaha — mamua ona, penei, *a* — *e*, o ka — *e* ka mea io ole, no ka mea, e unuhiia ae oia mailoko ae o ka *a*.

No ka pohihihi o ke ano o na mea io, a me na mea io ole

i na haumana hou, e kakauia kekahi mau hana i mea hoomaopopo.

1. He 12 ohia ia Wiliama, a haawi aku no ia i 5 ia Samuela. Ehia ana mau ohia e koe?

Ma keia ui, o na ohia he 12 ia Wiliama, he mea io ia, a o ka 5 e unuhiia'na i ikea ke koena, he mea io ole ia. $12 - 5 = 7$ na mea i koe.

2. He 12 ohia ia Wiliama, a haawi mai no Samuela i 5 mau ohia hou aku. Ehia ana mau ohia ilaila?

Maanei, e huiia'ku ka 5 me ka 12, nolaila he mea io ka 5. $12 + 5$.

3. Kuai kekahi i wati i na dala he 25, a kuai lilo aku ia i ua wati la i na dala he 30. Ehia na dala i waiwai ai oia ma ia kuai ana?

I ikeia kona waiwai ana, e unuhi iho i na dala i lilo aku mailoko ae o na dala i loaa mai. Nolaila, o ke 30 ka mea io, a o ka 25 ka mea io ole. $30 - 25$.

4. Kuai lilo aku kekahi i wati i na dala he 30, a ma ia kuai ana ua waiwai oia i na dala 5. Ehia na dala i make ai ua wati la i ke kuai lilo ana mai mamua?

Maanei, e unuhiia'i na dala i waiwai ai oia, mailoko ae o na dala kumukuai lilo aku. Nolaila, he mea io ole ka 5, penei, $30 - 5$.

5. He wahi puu dala kuai ka kekahi, he a na dala o kona puu; a i ka pau ana o ka makahiki, a huiia mai na dala ana i waiwai ai me na dala kumukuai, he e na dala o ka puu a pau. Ehia na dala o kona waiwai ana ia makahiki?

E unuhi i na a dala o ke kumukuai makamua noloko ae o na e dala ka puu a pau, i ka pau ana o ka makahiki, i ikeia'i kona waiwai ana. Nolaila, he mea io ole ka a, a penei e unuhiia'i ia, $e - a$.

Ina hoi kakou e manao ua emi kekahi mau dala o kana puu ma ke kuai ana, alaila, e uuku ka puu e, a e nui ae ka puu a, a e unuhi ae kakou i ka mea nui mailoko ae o ka mea uuku. Aka, aole ia he mea hiki. E hiki pono no

nae ka hoailona ia hana ana, penei paha, 18 — 32: a he mea pinepine ia ma keia helu, ke kuu kaawale ka mea io ole penei, — *w*, aole hoi he kumu no ka unuhi ana.

6. He puu dala 200 i kekahi, a he aie no kana i na dala 500, ehia na dala o kona waiwai ponoi?

O na dala i ke kanaka, he mea io ia, a o na dala ana i aie ai, he mea unuhiia, he mea io ole; nolaila, o na huahelu 200 — 500 ka hoailona o kona waiwai. Ina e uku aku ia i 200 na dala o kana aie, e koe auanei na dala — 300, aohe kumu e uku aku ai malaila.

Ina hoi i kapaia na dala aie he mea io, alaila, e lilo ai na dala ana 200 ka mea io ole, a 500 — 200 ka hoailona o na dala aie e hiki ole ke uku aku.

No ia mea, ua maopopo ke ano o ka mea io, a me ka mea io ole, he mau mea ku e laua i kekahi i kekahi. Ma na hana ana a pau, ina i kakauia kekahi mea i mea io, o na mea like a pau, a o na mea hoomahuahua mai ia mea, he mau mea io no hoi lakou; aka, o na mea ano ku e, a me na mea hooemi a pau ia mea io, he mau mea io ole lakou.

MOKUNA II.

HOULUULU.

PAUKU I.

Na mea kahi e like ana.

1. Haawi aku la ke alii i a mau dala na kekahi, a me 3 a mau dala na kekahi aku, a me 4 a mau dala na kekahi aku. Ehia a dala ana i haawi ai? Eia, 8 a dala.

Maanei 3 mau *mea kahi*, ua *ano like* lakou a pau, a he *mau mea io* hoi; no ka mea, ina aole i kauia ke kaha $+$ imua o kekahi hua, he *mea io* no kona ano. O ka haawina mua, he a ia, o ka lua o ka haawina, 3 a ia, a e hiki ke kakauia penei, $a + a + a$; a o ke kolu 4 a, oia hoi $a + a + a + a$. A i ka helu ana i na a a pau, ua ikeia 8 a o ka huina. Aka, o ka huina o ko lakou mau heluna 8 hoi ia. Nolaila, penei e hana'i na mea houluulu ano like, *E hoouluulu i na heluna, a e kau iho i ka huina imua o ka hua hoailona.*

Ina 5 ka mea i hoailonaia e ka a ma keia ùi, alaila,

$$a = 1 \times 5 = 5$$
$$3\,a = 3 \times 5 = 15$$
$$4\,a = 4 \times 5 = 20$$
$$8\,a = 8 \times 5 = 40$$

Ina hoi he huahelu okoa ka mea i hoailonaia e ka a, e like no hoi ka hana ana.

2.)	3.)	4.)	5.)
$4\,e$	$n\,w$	$5\,a\,e\,i$	$7\,h\,k$
$3\,e$	$2\,n\,w$	$6\,a\,e\,i$	$h\,k$
$5\,e$	$7\,n\,w$	$a\,e\,i$	$6\,h\,k$
$6\,e$	$3\,n\,w$	$2\,a\,e\,i$	$2\,h\,k$
$18\,e$	$13\,n\,w$		

6. E houluulu i $a\,w$, 3 $a\,w$, a me 5 $w\,a$.

Ua like ke ano o ka $a\,w$ a me ka $w\,a$; ina o ka $w = 6$, a o ka $a = 4$, alaila o ka 5 $a\,w = 5 \times 4 \times 6$, oia he 120, a o ka 5 $w\,a$, ua like me $5 \times 6 \times 4$, oia hoi ka 120. *Aka i ka houluulu ana, he pono no ke kakau iho i na hua e like me ko lakou kau ana ma ka papa Pia-pa.*

7. E houluulu i 3 $a\,e\,i$, 2 $a\,e\,i$ a me 4 $a\,e\,i$.

8. Heaha ka huina o 5 $a\,u\,m$, 3 $a\,u\,m$, $a\,u\,m$, 7 $a\,u\,m$, a me ka 17 $a\,u\,m$?

9. Ua aie kekahi i 4 a dala i kekahi manawa, a mahope iho i 5 a dala, a mahope iho i 6 a dala, a mahope i 8 a dala; ehia na a dala o kana aie ana?

10. Heaha ka huina o $a\,e\,i$, 5 $a\,e\,i$, 7 $a\,e\,i$, a me ka 12 $a\,e\,i$?

He mea pono no i ka haumana e kau i na huahelu ma kahi o na hoailona, a e houluulu ilaila e like me kela hana ana ma ka ui 6.

11. E houluulu i $-w - 3\,w$, a me $-5\,w$. Eia $-9\,w$.

Ua like keia houluulu ana me kela, aka o na hua he mea io ole lakou a pau. *Nolaila e kauia ke kaha — i ka huina*, i like ai kona ano me na hua i houluuluia.

Ina ma neia hana, o ka $w = 100$ dala, alaila, $-w = -100$, $-3\,w = -300$, $-5\,w = -500$; a o ka huina $-9\,w = -900$ dala. Ina e ninau mai kekahi, "Pehea la e hiki ai ke — 300, ke — 500 ke laweia mailoko mai o ka mea ole?" Ke i aku nei au, e hiki no ia ke hoailonaia ma ke kau ana i ke kaha —.

Ina paha e makemake kekahi kanaka kuai e ike i na dala ana i waiwai ai, a me na dala i poho ai ma kana kuai ana i kela mea keia mea; o na dala loaa mai, oia na *mea io*, a o na dala i poho, oia na *mea io ole* ma ke kakau ana, no ka mea e unuhiia lakou i ikea ai ka nui o kona waiwai e koe. Ina ma kekahi kuai ana ua poho $100, a ma kekahi aku, ua poho $300, a ma ka aie wale ana mai a ke-

kahi ua poho na dala 500, e kakauia ua mau poho ana la penei, — 100, — 300, — 500; a e hiki ke houluuluia lakou e like me na mea io, — 900, i mea e unuhiia'i mailoko ae o kekahi mea io.

12. E houluulu — 6 *m w*, — *m w*, a me — 16 *m w*.

13. Heaha ka huina o — 7 *a e i*, — 12 *a e i*, — *a e i*, — 6 *a e i*, a me 24 *a e i*?

14.) — 7 *m n w*
— 3 *m n w*
— 4 *m n w*
— 13 *m n w*

15.) — 12 *a e w*
— 4 *a e w*
— 6 *a e w*
— *a e w*

16.) — 7 *a e i o*
— 12 *a e i o*
— 16 *a e i o*
— 5 *a e i o*

17. Heaha ka huina o — 5 *a e w*, — 3 *a e w*, — 7 *a e w*, a me — 2 *a e w*?

18. Heaha ka huina o — 12 *a e n w*, — 7 *a e n w*, — 17 *a e n w*, — *a e n w*, a me — 2 *a e n w*?

19. E houluulu i — 3 *a*, — 7 *a*, — 12 *a*, a me — 16 *a*.

20. Heaha ka huina o — *n w*, — 3 *n w*, — *n w*, a me — 12 *n w*?

21. E houluulu i 3 *w*, a me — 2 *w*. Eia ka huina, *w*.

Ma keia hana he *mea io* kekahi hua, a he *mea io ole* kekahi; nolaila, ua ku e kekahi i kekahi, aole e hiki ke houluulu maoli, aka e pono ke kakauia penei, 3 *w* — 2 *w*, alaila e akaka ai ka mea i koe, he *w*, a oia iho la kona huina. Ina he aie ka kekahi i 30 na dala, oia ka mea io, a uku aku ia i na dala he 20, ua hoemiia ua aie la he 20; e kakauia oia penei 30 — 20, koe he 10 na dala.

22. E houluulu i 2 *w* a me — 3 *w*. Eia, — *w*.

Ua like keia me kela, aka o ka *mea io ole* ka mea oi. Nolaila e lilo ka huina *w* i *mea io ole*. No ka mea, ina he 20 na dala o ka aie, oia ka mea io, a ua ukuia mai na dala he 30, ua pau ka aie i ka ukuia a me na dala he 10 hou aku.

No keia mau mea, ua loaa mai keia kumu hana, ke like ole na kaha imua o na hua. *E unuhi i ka helung uuku*

mailoko ae o ka heluna nui, a e kau iho i kaha imua o ke koena e like me ke kaha imua o ka heluna nui.

Nolaila, ua ikeia ka hana ana i ka houluulu i kekahi manawa, ma kā unuhi ana, penei.

23. Heaha ka huina o 5 *m w*, a me — 3 *m w*? Eia 2 *m w*.

24.) + 4 *a e* 25.) + 7 *a b w* 26.) + 16 *a w*
— 3 *a e* — 5 *a b w* — 16 *a w*

27. E houluulu i ka 19 *a e i m*, a me — 27 *a e i m*.

28. Heaha ka huina o ka — 3 *a m w*, a me ka 5 *a m w*?

29. Heaha ka huina o 5 *w*, — 3 *w*, 4 *w*, a me — 2 *w*? Eia, 4 *w*.

Ina e kapa kakou i na mea io o keia ui he mau puu dala i loaa mai, oia 5 *w* a me 4 *w*, a me na mea io ole, he mau puu dala i ukuia'ku. Alaila, 9 *w* dala i loaa mai, a me 5 *w* dala i lilo aku; a koe no 4 *w* dala.

Ina he 100 dala ke *kumu* o ka *w*, alaila ua loaa mai 900, a ua lilo aku 500 dala, a koe iho no 400.

30. E houluulu i 4 *w*, — 8 *w*, — 7 *w*, a me 6 *w*. Eia, — 5 *w*.

Ua like ka hana ana i keia a me kela, aka, ua oi aku ka nui o ka mea io ole imua o ko ka mea io, a ua kahaia ka oi penei —. O ka huina o 4 *w*, a me 6 *w* = 10 *w*; a o ka — 8 *w* a me — 7 *w* = — 15 *w*; a o ke koena i unuhiia, he — 5 *w*.

Ina loaa mai i kekahi he 40 dala i keia hebedoma, a lilo aku he 80 i kela hebedoma aku, a me 70 i kekahi heb. hou aku, a i ka ha o ka hebedoma loaa mai na dala he 60, ua oi aku na mea lilo imua o na mea loaa he 50 na dala, a penei ka huina o ka mea lilo a me ka mea loaa mai, — 50. I keia hana ana, ua kapaia ke kumu o ka *w*, he 10 dala.

31. E houluulu i 5 *a b e*, — 7 *a b e*, 3 *a b e*, — *a b e*, a me 2 *a b e*. Eia, 2 *a b e*.

O ka huina o na mea io, he 10 *a b e* ia; a o na mea io ole, he — 8 *a b e*; a o ka 10 *a b e*, — 8 *a b e*, = 2 *a b e*.

Ina e houluuluia ana o na mea ano okoa, he mau mea io kekahi, a he mau mea io ole kekahi. *E hoolilo i na mea io a pau i huina hookahi, a me na mea io ole a pau i huina okoa, alaila e unuhi i ka huina uuku mailoko ae o ka huina nui.*

32. E houluulu i 8 *w*, — 3 *w*, 4 *w*, a me — 6 *w*.

33.) — 7 *a e*
3 *a e*
6 *a e*
— *a e*

34.) — 2 *e i*
5 *e i*
— 4 *e i*
6 *e i*

35.) *a e i o*
— 6 *a e i o*
— 8 *a e i o*
4 *a e i o*

36.) *p w*
3 *p w*
7 *p w*
— 10 *p w*

37.) 73 *h k l*
— 60 *h k l*
2 *h k l*
— 15 *h k l*

38.) — *m n w*
16 *m n w*
— 20 *m n w*
2 *m n w*

39. E houluulu i 4 *a n*, 5 *a n*, — 3 *a n*, 7 *a n*, — 6 *a n*, — 2 *a n*, 9 *a n*, a me — 19 *a n*.

40. E houluulu i 14 *a e u*, — 6 *a e u*, — 7 *a e u*, 3 *a e u*, 7 *a e u*, — 5 *a e u*, 3 *a e u*, — 2 *a e u*, — 7 *a e u*, 3 *a e u*, — 2 *a e u*, — 7 *a e u*, 3 *a e u*, 7 *a e u*, — *a e u*, — 8 *a e u*.

PAUKU II.

Na mea kahi e like ole ana.

1. Heaha ka huina o 4 *a*, 3 *m*, a me 5 *w*.

Eia, 4 *a* + 3 *m* + 5 *w*.

I keia ui, ua like ole na hua, he *a* kekahi, he *m* kahi, a he *w* kahi. Eia wale no ka mea hiki, o ka hoohui ia mau mea ma na kaha hui.

2. Heaha ka huina o 3 *e*, 7 *i*, a me — 5 *w*.

Eia, 3 *e* + 7 *i* — 5 *w*.

3. E houluulu i 6 *w*, — 5 *p*, 7 *m n*, a me — 4 *k*.

4. E houluulu i 7 *a e*, — 4 *i*, 12 *p w*, a me — 6..

5.)	6 *a b w*	6.)	19 *a w*	7.)	— 4 *n*	8.)	*a p*
	— 5 *a*		— 3 *a m n*		*w*		— 3 *k*
	— *w i*		*w i k*		— *a m i*		— *a b*
	27		— *a m*		— *h k*		— 61

9. Heaha ka huina o 4 *a e*, — 5 *a w*, — 3 *a e*, 6 *a w*, *a e i*, — *a e*, a me ka — 16? Eia, *a w* + *a e i* — 16.

Ma keia ui, e kau ana + 4 *a e*; a me — 3 *a e* me — *a e*, a hui pu, ua = — 4 *a e*. Nolaila, no ka hoonalo ana o ka + 4 *a e* i ka — 4 *a e*, aole i ikeia ma ka huina. E kau ana hoi ka + 6 *a w* me — 5 *a w*, a ua hoonaloia kekahi 5 iloko o ka + 6 *a w* e ka — 5 *a w*, a koe iho ka + *a w*, aole i nalo, oia ka hua mua o ka huina. A ua huiia mai ka + *a e i* a me ka — 16 no ke ku hookahi ana o ia mau hua.

Ina hana a pau, ua houluulu pono ia na mea like ole, ma ka hui pu ana i kela hua keia hua me ke kau ana i ko lakou mau kaha mawaena. Nolaila penei 4 *a e* — 5 *a w* + 6 *a w* — 3 *a e* + *a e i* — *a e* — 16, he huina ia o kela ui maluna. Aka o kela huina maluna ka hoemi ana o na hua e ku e ana i kekahi i kekahi.

Eia hoi kekahi mea akaka. Ina 2 mau hua like e ku e ana ko laua mau kaha penei + 5 *w* — 5 *w*, ua hoonaloia kekahi e kekahi.

10. Heaha ka huina o 16 *a e*, — 3 *a w*, *a e i*, — 12 *a e*, 3 *a w*, — 75, 40, a me — 4 *a e*? Eia, *a e i* — 35.

11.)	— 4 *a e i*	12.)	12 *a w*	13.)	— 5 *w*
	6 *a m w*		— *a n*		— 2 *w*
	7 *a e i*		3 *a w*		3 *w*
	— *m w*		— 14 *a w*		*a b e*

14. E houluulu i 5 *a e i*, 12 *w*, — 14 *a w*, — 4 *a e i*, — 16 *w*, 3 *m*, — 5 *a w*, 76, — *a e i*, 5 *w*, 83, a me 16 *a w*.

15. Heaha ka huina o ka 15 *a m w*, *a b*, — 2 *b m n*, — 12 *a m w*, — 24, 3 *b m n*, 17, — *a b*, 3 *a m w*, a me *w o*?

16. Heaha ka huina o ka 14 *a w*, 3 *b*, 2 *w*, 17 *i*, 37, — 4 *b*, — 15 *a w*, — 12 *i*, *a w*, 37, — 5 *i*, — 74, a me — *w*?

17. E houluulu i 6 *a b*, 5 *m n w*, 14, — 8 *a b*, 21, — 3 *m n w*, *e i*, 4 *a b*, — 35, a me — 2 *m n w*.

18. Heaha ka huina o 8 *n w*, — 5 *e i o*, 18, — 3 *n w*, — 9 *e i o*, — 12, a me 4 *e i o*?

19.) — 3 *h m*
54
+ 9 *h m*
— 60

20.) — 7 *m n w*
— 3 *h k*
8 *n w*
2 *h k*

21.) 754
a b w
— 649
m

22.) 8 *m n w*
— *m n*
— 3 *m n w*

23.) — *a b w*
— 7 2 3
5 *a b w*

24.) 9 *n w*
— 7 *n w*
n w

PAUKU III.

Na mea hui.

1. E houluulu i 3 *a* + 2 *b*, a me 5 *m* + 3 *w*.

Eia, 3 *a* + 2 *b* + 5 *m* — 3 *w*.

Ma keia hana ua kakauia na *mea hui*, aka ua houluuluia ua mau mea la e like me na mea *kahi*. *Ua hui pu ia na hua o lakou a pau ma ke kau ana i ko lakou mau kaha mawaena o kela hua a o keia hua.* Ina e manao kakou e houluulu i 4 + 5 a me 3 + 7, penei paha 4 + 5 + 3 + 7 = 19; a penei hoi paha, 4 + 5 = 9, a o 3 + 7 = 10, alaila e hui i ka 9 + 10 = 19. Ua like wale no ke ano o ia mau hana elua, aka aole e hiki keia hana hope ma keia helu, ke like ole na hua.

2. E houluulu i 5 *b* + 2 *e*, me 4 *h* — 3 *w*.

Eia, 5 *b* + 2 *e* + 4 *h* — 3 *w*.

Ua like keia me ka mua, aka, e kau ana ke kaha — imua o kekahi hua, nolaila e kauia hoi ia ma ka huina. Ma na

hua $4\,h - 3\,w$, ua hoemiia ka $4\,h$ ma ke $3\,w$. Nolaila i ka unuhi ana, e pono ke kau pu ia ka mea hoemi me ke kaha — mawaena o na hua.

E hoomaopopoia paha keia ma na hua helu, penei. E houluulu i $3 + 4$ me $8 - 6$. He $3 + 4 = 7$, a $8 - 6 = 2$; a $7 + 2 = 9$: oia ka huina o na hua i kauia. Eia hou, $3 + 4 + 8 = 15$. He 6 kona oi imua o ka 9; nolaila, ua pono ke unuhiia ke 6 mailoko ae o ka 15 i like. Penei $3 + 4 + 8 - 6 = 9$.

3. E houluulu i $5\,a + 2\,e$, me $3\,m - 4\,w$, a me $2\,h - p$.

Eia, $5\,a + 2\,e + 3\,m - 4\,w + 2\,h - p$.

4. E houluulu i $5\,a + 2\,b + e$, me $3\,w - 2\,b$, a me $4\,e - 3\,w - 6\,a$.

Eia $5\,e - a$.

Ma ka houluulu ana i na hua a pau, ua loaa keia huina,

$5\,a + 2\,b + e + 3\,w - 2\,b + 4\,e - 3\,w - 6\,a$.

Ma ka hoonalo ana $+ 2\,b - 2\,b$, $+ 3\,w - 3\,w$,

$5\,a + e + 4\,e - 6\,a$.

Hui pu i ka $e + 4\,e = 5\,e$,

Unuhi ana $5\,a - 6\,a = -a$.

Pau loa $5\,e - a$.

Pela no e hoonuiia'i ka huina ma ka hoonalo i na hua like e ku e ana i kekahi i kekahi.

5. Heaha ka huina $5\,a\,w + 3\,b\,e$ me $7\,a\,w - 4\,b\,e$, a me $-3\,a\,w + 17\,i$?

6. E houluulu i $3\,(a - b)$, me $2\,(a - b)$.

Eia, $5\,(a - b)$.

Ma keia hana ua like $3\,(a - b)$ me $3\,a - 3\,b$, a $2\,(a - b)$, $= 2\,a - 2\,b$. A o ka huina $5\,(a - b) = 5\,a - 5\,b$. Ina ka $a = 4$, a o ka $b = 2$, alaila o ke $3\,a - 3\,b = (12 - 6) = 6$: a o ka $2\,a - 2\,b = (8 - 4) = 4$. A o ke $6 + 4 = 10$: aka o $5\,a - 5\,b = (20 - 10) = 10$ no hoi.

O na mea hui e like ana, a i paa hoi maloko o na apo, e houluuluia lakou e like me na mea kahi. O na hua helu a o na hua *a* paha e kau ana mamua mai o ke apo,

he mau heluna lakou, a o lakou ke houluuluia. Aka, o na hua maloko o ke apo, aole e hoololiia ia mau mea.

7. Heaha ka huina o 6 ($5a - mw$), a me 3 ($5a - mw$)?

8. E houluulu i 4 ($ab - w + 3i$), 2 ($ab - w + 3i$) a me 5 ($ab - w + 3i$.)

9. E houluulu i 3 a ($mn - 6 + pw$), 2 a ($mn - 6 + pw$) a me 4 a ($mn - 6 + pw$.)

10. E houluulu i 2 ($be - nw$), 3 ($be - nw$), 4 ($be - nw$), 5 ($be - nw$), a me 2 ($be - nw$).

Eia ke kumu hana no na hana a pau o ka houluulu. *E hui pu i na hua a pau o na haawina ma ko lakou mau kaha, a e hoolilo i na mea like i hookahi.*

11. E houluulu i 3 $ab + 2e$, 5 $aw - e + 16$, 14 $- 3aw$, a me 5 $ab + 4e - i$.

12. E houluulu i 9 $m - 4i + 6w - hk + 8 - 2b + 7 + 4b - 3m + 7i - 4hk - m - 8b + 7 - 5w + 2i + 6m + w + 9b - 18 + 7hk - 10m - 4 - 3b - 5i - 2w - hk$.

E kakau hou ia ua hana la penei aku i mea e houluulu pono ia'i.

$$\begin{array}{rrrrrrrrrr}
 & 9m & - & 4i & + & 6w & - & hk & + & 8 - 2b \\
- & 3m & + & 7i & & & - & 4hk & + & 7 + 4b \\
- & m & + & 2i & - & 5w & & & + & 7 - 8b \\
 & 6m & & & + & w & + & 7hk & - & 18 + 9b \\
- & 10m & - & 5i & - & 2w & - & hk & - & 4 - 3b \\
\hline
\end{array}$$

13 houluulu i 5 $be + 2aw - 3i - 12 + 6aew - 8aw + 2i - 6be + 18 - 9aew + 14 + 9be - aw - 7i + 17 + 7be - 12i + 18 + 7aew - 6i + aw$.

14.)
$$\begin{array}{rrrrrrrrr}
 & 8w & - & 7i & + & 6m & + & 4 & - 2w \\
- & 4i & - & 9 & - & 2w & - & 6k & + 9m \\
 & 7m & - & 9w & + & 12 & - & 8i & + 4k \\
 & 10w & - & 4m & + & 3i & - & 6 & + 4w \\
\hline
\end{array}$$

15.) $8\,a\,b\,e - 5\,a\,(b - w) - 5 + m\,n\,p$
$3\,a\,(b - w) - 4\,a\,b\,e + 4\,w\,i\,k - 10$
$2\,a\,b\,e + 9 - 15\,m\,n\,p$

16.) $5\,a - 17 - 7\,a + m\,i$
$4\,(m - i) - 13 - 10\,m\,i + 21$
$8\,a + 8\,(m - i) - 2\,m\,i + a\,(m - i)$
$8\,m\,i + 9 - 3\,a - 10\,(m - i)$

17.) $16\,a\,b - 3\,p\,w + 9 - 5\,m$
$9\,p\,w - 3 + m - 9\,a\,b$
$4 - 3\,m - 18\,a\,b - 8\,p\,w$
$6\,m + 12\,a\,b + 2\,p\,w - 11$

18.) $9\,a\,m\,p - 15 + a\,(a - b) - b\,e$
$b\,e - 8\,a\,(a - b) + 36 - 5\,a\,m\,p$
$4\,a\,(a - b) - 5\,b\,e + a\,m\,p - 13$
$2 - 4\,a\,m\,p + 8\,b\,e + 5\,a\,(a - b)$

MOKUNA III.

KA UNUHI.

PAUKU I.

Ka unuhi ana i ka mea kahi.

1. Ina loaa mai i kekahi 5 *w* dala, a haawi aku ia i 3 *w* dala, ehia ana mau *w* dala e koe? Eia, 2 *w* dala.

Ma keia hana, no ka like ana o na hua. *Ua loaa ke koena ma ka unuhi ana i na heluna.* Ua kapaia na hua penei, 5 *w* — 3 *w*, alaila ua unuhiia ka mea i lilo mailoko o ka mea i loaa mai. A i ka unuhi ana, *ua hoololiia ke kaha* + *i* — *imua o ka mea lawe.*

Ina o ka *w* ka hoailona no ka 5, alaila 5 *w* = 25, a 3 *w* = 15, a 25 — 15 = 10, oia 2 *w* dala e like me kela mamua.

2.) Mailoko aku o 3 *w* — E lawe i *w* — 2 *w*

3.) 5 *b* — 2 *b*

4.) 16 *i* — 4 *i*

5.) 9 *w* — 2 *w*

6.) Mailoko o ka 16 *a e i* — E lawe i 2 *a e i*

7.) 4 *m n p* — *m n p*

8.) 14 *m i* — 3 *m i*

9. E unuhi i 5 *a w* mailoko o ka 7 *a w*.
10. E unuhi i 9 *m n p* mailoko o ka 10 *m n p*.
11. E lawe i 6 *a w* noloko mai o 6 *a w*.
12. E lawe i 7 *h m p* noloko o ka 19 *h m p*.
13. E unuhi i ka *b* noloko o ka *a*. Eia *a* — *b*.

No ka mea he okoa kahi hua i kekahi, aole e hiki ke

unuhi maoli, aka, e hoailona wale i ka unuhi ma ke kau ana i ke kaha — imua o ka hua unuhi.

Ina o ka $a = 12$, a o ka $b = 8$, alaila, $a - b$, oia $12 - 8 = 4$; oia ka mea i koe mahope o ka unuhi ana. Maanei hoi ua hoololiia ke kaha + imua o ka mea unuhi i —.

14. Mailoko o ka 5 *m* e lawe i 2 *w*. Eia $5m - 2w$.

15.) Noloko o 5 *a* — E lawe i ka *b* — $5a - b$

16.) $7w - 3u$

17.) $2m - 3n$

18.) $19a - 2i$

19.) Noloko o $14aei$ — E unuhi i $2mn$

20.) $12apv - 29hm$

21.) $19a - 2i$

22. E unuhi i 5 *n i*, mailoko ae o ka 4 *w*.
23. Mailoko o ka *w*, e lawe ae i ka 13 *b e*.
24. Noloko o ka 7 *m w*, e lawe i *p*.
25. E unuhi i *m n* mailoko ae o *b e*.
26. E lawe i 13 *b e* noloko o ka *w*.
27. E lawe i 27 *m n* noloko o ka *p*.
28. E lawe i ka *b e* noloko mai o ka *m n*.
29. Noloko o ka *m n p* e lawe i ka *m n*.
30. E lawe i 16 noloko o ke 32 *a b e*.
31. Noloko o ka 8 *a b e w* e lawe i 4 *a b e*.

PAUKU II.

Ka unuhi i na mea hui.

1. Aia no he 4 *m* dala i kekahi kanaka, a ua uku aku ia i 3 *m* dala, a me *i* dala hou aku. Heaha kana mau dala e koe? Eia, $m - i$ dala.

O ka mea a pau i ukuia, he $3m + i$. A ina ua unuhiia 3 *m* wale no, aole no e pau ka mea lawe ilaila, no ka

mea, koe no ka i. Nolaila, e kakauia oia penei, $4\,m - 3\,m - i$; a o keia hoi i hooliloia ilalo he $m - i$ ia.

E hoomaopopo hoi ma na hua helu, $m = 5$; a $i = 3$; alaila, $4\,m = 20$, a me $3\,m + i = 15 + 3 = 18$: a o ka $20 - 18 = 2$, a o ka $20 - 15 - 3 = 2$ no hoi. I keia mau hua hope, e hiki ke unuhi i 15 noloko o ka 20, alaila, e unuhi i 3 mailoko aku o ke koena; a e hiki no hoi ke hui aku i 3 me ka 15 a e unuhi iho i ka huina noloko o ka 20. *Ina i hana, ua hooloiia na kaha + o na mea unuhi, a lilo i —.*

2.) E unuhi i $3\,a + b$ noloko o $5\,w$. Eia, $5\,w - 3\,a - b$.

3.) Noloko o $3\,a$
E lawe i $2\,a + b$.
$a - b$.

4.) $5\,a\,b\,e$
$a\,b\,e + i$

5.) $4\,w$
$b + p$.

6.) Noloko o $a\,b\,e\,o$
E lawe i $2\,m + 3\,i$.

7.) 47
$w + p\,e$.

8.) $a\,b\,w$
$3\,a\,w + 12$.

9. Noloko o $6\,a$ e lawe i $3\,a + b$.
10. E lawe i $2\,m + p$ noloko o $4\,a$.
11. E lawe i $w + 16$ noloko o ka w.
12. E lawe i $23 + w$ noloko o ke 40.
13. E lawe i $4\,i + w$ noloko o $b\,e$.
14. Noloko o ka i, e lawe i ka $i + w$.
15. E lawe i $4 + w$ noloko o ka 5.
16. Noloko o $5\,m\,n$ e lawe i $m\,n + 5$.
17. E lawe i $36 + 2\,i$ noloko o ke 48.
18. E lawe i $m\,w$ noloko o $2\,m$.
19. Noloko o $5\,n$ e lawe i $3\,n - w$.

Ma keia lawe hope ana, e unuhiia ke $3\,n - w$ mailoko aku o ka $5\,n$. Aole hoi i unuhiia ke $3\,n$ okoa, aka i ke koena mahope o ka lawe ana i ka $- w$. Nolaila, ina e unuhi kakou i ke $3\,n$ okoa, he nui loa ia, aole e loaa ke koena pono a huiia aku ka $- w$ i ua koena la. Penei e

kakauia'i ia hana, $5n - 3n + w$. A hoemiia oia ilalo, penei $2n + w$.

Eia hou. Ina o ka $n = 6$, a o ka $w = 4$; alaila, $5n = 30$, a $3n - w = 18 - 4$, a o keia ka mea lawe $18 - 4$ noloko ae o ke 30. A o ka $18 - 4 = 14$, a o ke $30 - 14 = 16$, oia ke koena pono. Ina e lawe kakou i 18 okoa noloko ae o ke 30, he nui loa ka mea lawe, nolaila he pono ke hui aku i ka 4 i ke koena, i loaa'i ke koena pono, penei $30 - 18 + 4 = 16$. *Ma neia hana ana, ua hooloiia na kaha a elua, o ka* $+ i -$, *a o ka* $- i +$.

20.) Noloko o $14\,a\,b$
E lawe i $12\,a\,b - m\,n - w$
$2\,a\,b + m\,n + w$

21.) $17\,m\,n$
$12\,m\,n - a\,b\,c$

22.) Noloko o $5\,a\,b$
E lawe i $5\,a\,b - 7 + w$.

23.) $27\,m\,n$
$19\,m\,n - w - 3\,a\,b$.

24. E lawe i ka $b\,e$ — 8, noloko o ka 16.
25. E lawe i ka $m\,n\,w$ — a, noloko o ka $b\,e\,m$.
26. Noloko o ka $a\,b$, e lawe i ka i — w.
27. Noloko o ke 48, e lawe i ka m — 16.
28. E lawe i ka $o\,u$ — i, noloko o ka $b\,w$.
29. E lawe i ka $m\,n\,w$ — $9\,m$, noloko o ka $a\,b\,e$.
30. Noloko o ka i, lawe i ka i — 4.
31. E lawe i ka $a\,b + 7$, noloko o ka $a\,w$.
32. E lawe i ka $m\,n$ — $9\,a$, noloko o ka $2\,m\,n$.
33. Noloko o ke $3\,a\,b$, e lawe i $2\,a\,b + 9$.
34. E lawe i $5\,m$ — 5, noloko o ka $4\,m$.
35. Noloko o ka 18, e lawe i ka w — 18.
36. E lawe i ka $a + b$, noloko o ka a.
37. E lawe i ka $12 + 4\,a$, noloko o ka 27.
38. E lawe i ka $a + 12$, noloko o ka 19.
39. Noloko o ka $5\,(a + b)$, e lawe i $2\,(a + b) - w$.
40. Noloko o ka $m\,(m - i)$, e lawe i $2\,m\,(m - i) - mi$.
41. E lawe i ka $a\,w + b$, noloko o ke $3\,a\,w$.

PAUKU III.

He kumu hana no ka unuhi ana.

1. Noloko ae o ka w e unuhi i ka $— w$. Eia, $2w$.

Ma ka mea i hoakakaia mamua, ua lilo ka $— w$ i $+ w$ ma ka unuhi ana. Nolaila o ka $w + w = 2w$; oia hoi. *O ka unuhi ana i ka mea io ole, ua like ia me ka hui ana mai i ka mea io ano like.* Ina he aie ka A i $100, i ko kakou helu ana i kona waiwai a pau, e pono ke unuhi kakou ia puu dala noloko mai o ia waiwai. Aka, ina e uku aku o E i ua aie la, oia ka unuhi i ua mea io ole la noloko, a ua hookahi no ia me ka hoomahuahua ana i ko A waiwai i hookahi 100 dala hou aku, e like me ka haawi maoli ana ia puu dala ma kona lima.

2. Noloko ae o ka $a + b$ e unuhi i ka $e — i$.

Eia, $a + b — e + i$.

E unuhi maanei i ke koena mawaena o na mea elua o $e — i$, noloko ae o ka huina o na mea e ae elua, o $a + b$. Ina o $a = 8$, a o $b = 6$; $e = 11$, a o $i = 2$; alaila ua loaa he $8 + 6$, noloko ae o ko laua huina e laweia'i ka $11 — 2$: oia hoi keia $14 — 9 = 5$. Aka $8 + 6 — 11 + 2$ ua like hoi ia me ka 5 maluna. Ua hoololiia na kaha o na mea e unuhiia ana; *aka o na hana a pau, aole i hoololiia na kaha o kela mau kumu unuhi.*

Eia ke KUMU HANA NO KA UNUHI ANA.

E hooloii i na kaha a pau o na mea unuhi, o na kaha + i mau kaha —, a o na kaha — i mau +, a e hookui i na mea like, e like me ka houluulu ana.

O ka hooloii ana i na kaha, oia no ka unuhi ana. O ka hana i koe mahope o ke kau ana, oia no ka hoemi i na hua, ma ka hookui ana i na mea like, a me ka hoonalo ana i na mea ku e.

3. Noloko o ka w, e unuhi i ka $(a + b — c)$.

Eia, $w — a — b + c$.

I keia hana ana, o na hua a pau mawaena o ke apo ($a + b - e$), e laweia keia noloko o ka w: nolaila e hoololiia na kaha.

4. Noloko o ka $a\,b$, e lawe ($-e\,m - l + 16$).
Eia, $a\,b + e\,m + l - 16$.

5.) Noloko o ke $6\,m + 3\,i$
E lawe i $5\,m - 4\,i$
$m + 7\,i$

6.) $17\,m\,n\,w + 14 - a\,b.$
$13\,a\,b + 24 + 18\,m\,n\,w$
$-14\,a\,b - 10 - m\,n\,w.$

7.) Nol. o $17\,m\,n - 102 - 12\,a\,b\,m$
E law. i $47\,a\,b\,m - m\,n - 3\,a\,b.$

8.) $7\,m\,w + 14\,i$
$14\,i + 6\,n$

9.) Nol. o ka $a\,e\,w + 3\,i\,m$
E lawe i ke $3\,i\,m + a\,e\,w$

10.) $21\,m\,n\,w - 34 + p$
$21 + p - 14\,m\,n\,w$

11.) Nol. o $a\,n + o\,p$
E law. i $m\,p\,w - 60$

12.) $19\,a\,b\,w - 2\,a\,m\,n - 7\,b\,i\,e$
$3\,a\,b\,e + 5\,b\,i\,e - a\,m\,n.$

13.) Nol. o ka $w + i$
E law. i ka $w - i$

14.) $l\,e\,w - 15 + 7\,a\,b + 25\,w$
$24 + 2\,l\,e\,w - 8\,w.$

15.) Nol. o ka $24\,w + 3\,i\,k - 12\,a\,b\,e - m\,n\,p + 5$
E lawe i $16\,a\,b\,e - 6\,m\,n\,p + 23\,w + i\,k + 12 - w\,i.$

16.) Nol. o ka $w + i + k$
E lawe i ka $w - i - k$

17.) $3\,a\,b\,k - 14 + 6\,a$
$3\,a\,b\,k - 14 + 6\,a.$

18.) Noloko o ke $3\,k + 5\,i - p$
E lawe i ka $2\,k + 5\,i + p$

19.) $8\,a\,m - k\,t$
$3\,a\,m - h.$

20.) Noloko o ke $6\,m\,p - 8\,a\,k + 12 - 14\,m\,k\,i$
E lawe i ke $6\,m\,p + 8\,a\,k - 12 + 14\,m\,k\,i.$

21.) Nol. o ke $3\,a\,k + 5\,a\,i - 2\,a\,b$
E lawe i $2\,a\,k + 5\,a\,i - 3\,a\,b$

22.) $5\,a\,m - 17$
$18 + 2\,a\,m.$

MOKUNA IV.

KA HOONUI ANA.

PAUKU I.

Na mea kahi.

I. Heaha ke kumu e make ai i na alani 5, hookahi alani 1 *a* keneta? Eia, 5 *a* keneta.

He mea akaka, ina hookahi *a* keneta o ka alani 1, he pa 5 ke kumu kuai i na alani 5. Nolaila ina $a = 2$ mau keneta, alaila $5\ a = 5 \times 2$ oia he 10 na keneta.

He mea houluulu pokole o ka HOONUI ANA, *i ka manawa e like ana na mea houluulu.* I ka manawa e like ole ana na mea houluulu, e loaa ka huina o ia mau mea ma ka hui pu wale ana ma ka houluulu maoli. Ina hoi he like na hua, e hiki no ke loaa ka huina ma ka houluulu, penei,

$2 + 2 = 4$ eia hoi $2 \times 2 = 4$,
$2 + 2 + 2 = 6$ $2 \times 3 = 6$,
$2 + 2 + 2 + 2 = 8$ $2 \times 4 = 8$,
$2 + 2 + 2 + 2 + 2 = 10$, $2 \times 5 = 10$;

Ma ka hana mua ana ua like na huina me na mea i loaa ma ka hoonui ana i ka hana mahope ma ka hoonui ana.

Pela hoi ma na hoailona, ina e make ka alani hookahi i na *a* keneta, e make no hoi 2 alani i 2 *a*, oia $a + a = 2\ a$, ekolu alani, $a + a + a = 3\ a$, eha alani, $a + a + a + a = 4\ a$, elima, $a + a + a + a + a = 5\ a$ e like mamua.

Nolaila, ina e hoonui oe i ka hoailona me ka hua helu, *e pono no e kau i ka huahelu mamua o ka hoailona i helu na no ua hoailona la.*

Ma ka helu, ua kapaia ka mea e hoonuiia'na *he Kumu hoonui*, a o ka mea hoonui aku, ua kapaia o ka *Hoonui*, a o ka mea loaa ma ka hoonui ana, o ka *Huina hoonui*. A ua kapaia hoi ke kumu hoonui a me ka hoonui e kau pu ana, o na *Haawina*.

2. Ina e make ka iwilei lole i na *a* dala, ehia *a* dala e make i na iwilei 6? Eia, 6 *a* dala.

He mea pono na ka haumana e hoomaopopo i ka oiaio o kana hana ana ma ke kau ana i na huahelu ma kahi o na hoailona, a e hana hoi malaila.

3. Ina he *w* na uala maloko o kekahi pahu, ehia na *w* uala moloko o na pahu 9? Eia, 9 *w* uala.

4. Ina he *m* mau dala ka uku kuala o kekahi puu dala no ka makahiki aie 1; ehia *m* dala ka uku kuala no na makahiki 8?

5. Ehia na busela palaoa iloko o kekahi kihapai he 12 mau akere, hookahi akere, 1 *a* busela palaoa?

6. Heaha ke kumu kuai i na iwilei lole he 10, ke make ka iwilei 1 i *e* mau dala?

7. Haawi aku la kekahi kanaka i *a* mau dala i kela la i keia la, ehia mau *a* dala i lilo i ka hebedoma 1?

8. Ina e hoolilo aku kekahi i *a* mau dala i kela la i keia la, ehia na *a* dala i lilo i ka makahiki 1?

9. Ina he *w* mau iwilei lole iloko o ka apa 1, ehia mau *w* iwilei iloko o na apa he 15?

10. Ina e hana kekahi a paa he *a* mau anana papohaku i ka la 1, ehia na *a* anana e paa ia ia i na hebedoma 3?

11. Ina he *e* mau aniani iloko o kekahi puka aniani, ehia mau *e* aniani iloko o na puka he 14?

12. Heaha ke kumu kuai i *a* mau iwilei lole, he *e* mau keneta o ka iwilei 1? Eia, *a e* mau keneta.

E hoonui i ka *e* ke kumu kuai i ka iwilei 1, me na iwilei a pau, me ka *a*; penei $a \times e$, a penei hoi, *a e*. Ina $a = 7$, o ka $e = 12$, alaila $a \times e = 7 \times 12 = 84$.

Ina paha ka $e\ i$ ke kumu kuai i ka iwilei 1, ina ua hoonuiia ua $e\ i$ la me ka a penei, $a\ e\ i$.

Ina paha hoi i hoailonaia na iwilei i ka $a\ b$, a o ke kumu kuai he $e\ i$ na keneta, alaila e hoonuiia kekahi me kekahi penei, $a\ b\ e\ i$, oia ka huina.

Nolaila, ina e hoonui kakou i kekahi hua hoailona me kekahi hua hoailona: *E kakau pu kakou i na hua a pau ma ka lalani hookahi.*

13. Ina he w na kanaka e hana a paa kekahi hana i na a la, ehia mau la e hana ai ke kanaka 1 a paa ia hana?

Eia, he $w\ a$ mau la.

14. E hoonui i $a\ m$ me ka i.

15. E hoonui i $b\ e$ me ka $m\ n$.

16. E hoonui i ka $a\ b\ e$ me ka $i\ k$.

17. E hoonui i ka $a\ m\ n$ me ka $h\ k\ l$.

18. E hoonui i ka $a\ b\ e$ me ka $h\ m\ n$.

19. E hoonui i ka m me ka $a\ e\ i$.

20. E hoonui i ka $m\ p\ w$ me ka $a\ b\ i$.

21. Ina e hele ka lio i na b mile i ka hora 1, ehia na mile e hele ai ia i na 2 a hora? Eia, 2 $a\ b$ hora.

Ina $b = 6$, a o ka $a = 5$, alaila $2\ a = 2 \times 5 = 10$, a o ka $2\ a\ b = 2 \times 5 \times 6 = 60$. Eia hoi, ina a hora e hele ia i na $a\ b$ mile, a i na 2 a hora e paluaia na mile, oia $2\ a\ b$ mile.

22. Heaha ke kumu kuai i na i paila wahie, ke make ka paila 1 i 4 a dala?

23. E hoonui i 4 $a\ b$ me ka $p\ w$.

24. E hoonui i ka $a\ w$ me ka 7 $b\ e$.

25. E hoonui i ka i me ka 9 $a\ b\ m$.

26. E hoonui 7 $a\ b\ n$ me ke $k\ m\ p$.

27. E hoonui i ka $a\ k\ l$ me ka 12 $b\ e\ i$.

28. E hoonui i ka 9 $a\ m\ n$ me ka w.

29. E hoonui i 4 i me ka $a\ b\ m$.

30. E hoonui i ka 17 $a\ m\ w$ me ka $b\ e\ i\ k$.

31. Heaha ke kumu kuai i 5 pahu palaoa, he 2 *a* dala o ka pahu hookahi? Eia, 10 *a*.

Ina e make ka pahu 1 i 2 *a* dala, e make hoi i 5 pahu i $5 \times 2\,a$ dala, oia he 10 *a* dala. Ina o ka $a = 3$, alaila $2\,a = 2 \times 3 = 6$ dala o ka pahu 1: a e make na pahn 5 i $5 \times 6 = 30$ dala. Aka o ka $10\,a = 10 \times 3 = 30$ dala. Eia hoi, $10\,a = 10 \times 3 = 30$ dala, oia like no.

32. He 4 mau puka kahe o ka pahu wai, e kahe ana 5 *w* galani wai ma kela puka keia puka i ka hora 1. Ehia na *w* galani e kahe iho ai ma na puka a pau i na hora 2? Eia, 40 *w* galani.

33. E hoonui i 8 *a w* me ka 4.

34. E hoonui i 12 *a b w* me ke 6.

35. E hoonui i 9 *a b e* me ka 2.

36. E hoonui i 15 *a* me ke 3.

37. E hoonui i 8 *m n p* me ka 14.

38. E hoonui i 12 *b e m n* me ka 18.

39. E hoonui i 73 *b m p* me ke 42.

40. E hoonui i 19 *a b m k* me ka 12.

41. Ina e loaa mai i kekahi 2 *b* dala i kela la i keia la, ehia na dala o ia i 6 *a* mau la? Eia, 12 *a b* dala.

Maanei ua hoonuiia na dala o ka la 1 me na la 6, a ua loaa 6 *a* 2 *b*. Ina o ka $a = 2$, a o ka $b = 4$; alaila $2\,b = 8$, a o ke $6\,a = 12$, a o ka $8 \times 12 = 96$. E aho hoi e hoonui pu i na huahelu 2 me ke $6 = 12$, a o ka 12 *a b*, oia $12 \times 2 \times 4 = 96$ e like me ia maluna.

Ina he 2 *mau huahelu okoa i kakauia, e hookaawale ia laua i ka hoailona paha, i ke kaha* × *paha e pono ai*; no ka mea, ina o ka $a = 2$, a o ka $b = 4$, alaila,

$$6\,a\,2\,b = 6 \times 2 \times 2 \times 4 = 96.$$
$$26\;a\,b = 26 \times 2 \times 4 = 208.$$
$$62\;a\,b = 62 \times 2 \times 4 = 496.$$

Nolaila, eia ke KUMU kuhikuhi i ka hoonui ana i na *mea kahi. E hoonui pu i na hua helu, oia na heluna, a e*

kau iho ma ka akau i na hua hoailona a pau i huina no na mea i hoonuiia.

42. E hoonui i 5 $a\,b$ me ke 6 w.
43. E hoonui i 8 $a\,k$ me ke 3 $m\,n$.
44. E hoonui i 19 $m\,n$ me ka 4 $b\,k$.
45. E hoonui i 24 $k\,l\,p$ me ha $b\,e$.
46. E hoonui i 12 $m\,n$ me ke 52.
47. E hoonui i 19 $n\,p$ me ka 13 $a\,b\,e$.
48. E hoonui i ka $p\,w$ me ka 14 $a\,m$.
49. E hoonui i ke 71 $a\,m$ me ka 22 $b\,h\,k$.
50. E hoonui i ka 19 i me ka 12 $a\,w$.

PAUKU II.

Na mea hui.

1. Haawi aku la kekahi i a mau dala na kana keikikane, a me b mau dala na kana kaikamahine i kela hebedoma i keia hebedoma. Ehia mau dala ana i haawi aku ai i na e hebedoma? Eia, $a\,e + b\,e$ dala.

Haawi aku la ia i $a + b$ dala i na keiki a elua i ka hebedoma 1. Eia no ka *mea hui* $a + b$ he mea e hooonui pu ia me ka *mea kahi*, me ka e. Na ke keikikane he $a\,e$ dala, a na ke kaikamahine he $b\,e$ dala; e hui pu, he $a\,e + b\,e$ na laua a elua.

Ina o ka $a = 4$, a o ka $b = 3$, a o ka $e = 5$, alaila, o ka $a\,e = 20$, a o ka $b\,e = 15$, a o ka $a\,e + b\,e = 20 + 15 = 35$. Eia hou, $a + b = 4 + 3 = 7$; a o ka $7 \times 5 = 35$ e like me kela.

2.) E hoonui i $4\,a + 5\,b$
Me ke $3\,e$
$12\,a\,e + 15\,b\,e$

3.) $a\,b + 3\,a\,w$
$5\,a\,e$
$5\,a\,a\,b\,e + 15\,a\,a\,e\,w$

4. E hoonui i $b + b\,e + 5\,m\,n + 13$ me $a\,b$.

5. E hoonui i 6 $a\,b + 8\,i + 19\,b$ me 4 $a\,w$.
6. E hoonui i 12 $b + 8\,k + 15$ me ka 7 $a\,k\,l$.
7. E hoonui i 11 $a\,b + n + i$ me 9 $a\,m\,n$.
8. E hoonui i $e\,i + m + 4 + k$ me $a\,b\,w$.
9. E hoonui i 6 $l\,m + w + 5\,i + 1$ me ka 7 $a\,m$.
10. E hoonui i 5 $a\,m\,w + 1 + 3\,w + i$ me $a\,b\,k$.
11. E hoonui i 7 $n\,w + 5\,i + 8\,a$ me 4 $b\,e\,m$.
12. E hoonui i 9 $k\,i + 1 + 6\,a\,k$ me ka a.
13. E hoonui i $e\,l + b + e + a + w$ me ka $a\,b$.
14. E hoonui i 7 $a\,b + 9\,a\,b\,m\,n + 2$ me ka $e\,l$.

15. Heaha ka huina ke hoonuiia ka $a + b$ me ka $m + n$?

Eia, $a\,m + b\,m + a\,n + b\,n$.

Ma keia hana ana he mau *mea hui* ke *kumu hoonui* laua o ka *mea hoonui*. Ina e hoonui kakou i ka $a + b$ me ka m wale no, eia ka huina, $a\,m + b\,m$. Aka, no ka mea, he mea hoonui hoi ka n, e hui aku hoi i ka huina o kona hoonui ana, ka $a\,n + b\,n$ me kela.

Ina o ka $a = 2$, a o ka $b = 3$, $m = 4$, o ka $n = 5$, alaila e hoonuiia $2 + 3$ me ka $4 + 5$. A $2 + 3 = 5$, a $4 + 5 = 9$, a o ka $5 \times 9 = 45$. Penei hoi e kakau ai,

$$\begin{array}{r} 2 + 3 \\ 4 + 5 \\ \hline 8 + 12 \\ \quad 10 + 15 \\ \hline 8 + 12 + 10 + 15 = 45. \end{array}$$

16. Heaha ka huina ke hoonuiia $2\,a + 3\,b$ me $3\,a + 2\,b$?

$$\begin{array}{r} 2\,a + 3\,b \\ 3\,a + 2\,b \\ \hline 6\,a\,a + 9\,a\,b \\ \quad 4\,a\,b + 6\,b\,b \\ \hline 6\,a\,a + 13\,a\,b + 6\,b\,b. \end{array}$$

Ua hui pu ia ka $9\,a\,b$ me ka $4\,a\,b$ no ka like o laua. Ina he mau *mea hui* ke kumu hoonui a me ka hoonui. E

hoonuiia kela hua keia hua o ka mua me kela hua keia hua o ka hope; a e houluulu i ko lakou mau huina.

17. E hoonui i 9 $a\,i + b\,e$ me ka $b\,e + a\,i$.
18. E hoonui i 3 $a\,b\,e + 8\,a\,i + w$ me ka $a\,b\,c + w$.
19. E hoonui i $b + e + 8$ me ka $b + e + 10$.
20. E hoonui i $m + n + w + 4$ me ka $a + e$.
21. E hoonui i $3\,a\,b + e + n\,w$ me ka $n\,w + e + a\,b$.
22. E hoonui i $4\,a\,b + 2\,b + 5\,a$ me $3\,a + 7\,b$.
23. E hoonui i $a\,b + 4$ me ka $5 + a\,b$.

PAUKU III.

Na kaha ma ka hoonui ana.

Ma na pauku i hala ae nei, he mau mea io wale no ka i hanaia, aole no i haiia'ku na kanawai o na kaha, no ka mea: *He mea io no ka huina o na mea io elua i hoonuiia.*

1. Ua loaa mai i kekahi kanaka he a mau dala i kela hebedoma keia hebedoma, a ua hoolilo aku i b mau dala ia manawa. Ehia mau dala oi o ka loaa ana i e mau hebedoma? Eia, $a\,e - b\,e$ mau dala.

Maanei he $a - b$ ka mea e hoonuiia e ka e. O na dala loaa mai i na hebedoma a pau, he $a\,e$ mau dala, a o na dala i lilo aku ia manawa, he $b\,e$ no ia. Nolaila ua hoike mai ka $a\,e - b\,e$ i ka oi ana o ka $a\,e$ imua o ka $b\,e$.

Ina o ka $a = 12$, a o ka $b = 10$, a o ka $e = 5$, alaila,

$$\begin{array}{rr} a - b & 12 - 10 = 2 \\ e & \quad 5 \quad 5 \\ \hline a\,e - b\,e & 60 - 50 = 10. \end{array}$$

Maanei, *o ka — i hoonuiia me ka +, ua loaa ka — ma ka huina.*

2. E hoonui i ke $3\,w - b\,w$ me ka $a\,e$.
3. E hoonui i ka $8\,a\,b - 1$ me ka $a\,w$.

4. E hoonui i ka $9\,a\,w - 17\,w$ me ke $3\,a\,e$.
5. E hoonui i ka $a - b\,w - m\,n$ me ka $h\,k$.
6. E hoonui i ka $a\,b + w - 1 + a$ me ka $m\,a\,p$.
7. E hoonui i ke $3\,m\,n - b\,m$ me ka $5\,e\,i$.
8. E hoonui i ka $a\,b\,e - 1 + 6\,m$ me ka $9\,n\,w$.
9. E hoonui i ka $a\,m - 4 - m$ me ka $a\,m + m$.
10. E hoonui i ka $b\,e\,w - 16$ me ka $a\,e + m\,n$.

11. Heaha ka huina o ka $a + b$ i hoonuiia me ka $m - n$? Eia, $a\,m + b\,m - a\,n - b\,n$.

Hoonui mua kakou i ka $a + b$ me ka m, a ua loaa ka $a\,m + b\,m$; aka ua oi loa aku ia imua o ka huina pono, ma ka oi ana o ka m imua o ka n. Nolaila, e hoonui hoi kakou me ka n, a e unuhi i ka huina $a\,n + b\,n$ mailoko ae o ka $a\,m + b\,m$. Aka i ka unuhi ana ua lilo ia i $-a\,n - b\,n$.

Ina o ka $a = 7$, $b = 5$, $m = 10$, a o ka $n = 4$; alaila,

$a + b$	$7 + 5 = 12$
$m - n$	$10 - 4 = 6$
$a\,m + b\,m$	$70 + 50 \quad 72$
$-a\,n - b\,n$	$-28 - 20$
$a\,m + b\,m - a\,n - b\,n$	$70 + 50 - 28 - 20 = 72.$

Ma keia hana ana, o ka + i hoonuiia me ka —, ua lilo ka huina i mea —.

12. E hoonui i $3\,a + b\,i$ me ka $n - p$.
13. E hoonui i $a\,b + e + w$ me ka $2\,e - h$.
14. E hoonui i $5\,a + 2\,b$ me ke $6\,a - 3\,b$.
15. E hoonui i $m + n + w$ me ka $m - n - w$.
16. E hoonui i $5\,w + 5$ me ke $3\,w - 3$.
17. E hoonui i $a\,b\,w + e\,m$ me ke $1 - 5\,i$.
18. E hoonui i $l\,m + a + 16$ me ka $-8\,m$.
19. E hoonui i $a + 5 + w$ me ka $a - w - 5$.
20. E hoonui i $h\,m + 16 + i$ me ka $9\,b - 8\,b$.
21. E hoonui i $a - b$ me $m - n$.

Eia, $a\,m - b\,m - a\,n + b\,n$.

Ke hoonui mua nei kakou i $a - b$ me ka m, a ua loaa $a\,m - b\,m$ i huina. Aka, no ka mea, ua hoemiia ka m i ka $- n$, he pono no e hooemi i ka huina $a\,m - b\,m$ i ka huina o ka $a - b$ i hoonuiia me ka n, a e unuhi iho mailoko ae o kela. O ka huina o $a - b$ i hoonuiia me ka n, eia no $a\,n - b\,n$, a i ka unuhi ana lilo ae la ia $- a\,n + b\,n$.

Ina o $a = 15$, $b = 5$, $m = 12$, a o ka $n = 8$, alaila,

$a - b$	$15 - 5 = 10$
$m - n$	$12 - 8 = 4$
$a\,m - b\,m$	$180 - 60 \quad 40$
$- a\,n + b\,n$	$- 120 + 40$
$a\,m - b\,m - a\,n + b\,n.$	$180 - 60 - 120 + 40 = 40.$

Nolaila, ua maopopo keia mea, *O ka — i hoonuiia me ka — ua lilo ka huina i +.* He mea pohihihi keia i na haumana. Aole i akaka ia lakou, ina e hoonui kakou i ka mea io ole me ka mea io ole, ua loaa mai ka mea io ma ka huina. Aka aole he *hoonui* wale no ke ano o keia hana ana, he *unuhi* hoi kekahi. Mamua, he hoonui ka kakou i na mea io ole me he mea io la, a mahope ma ka hoololi ana i na kaha a pau, ua unuhi kakou i ka huina mailoko aku o kela huina mua.

22. E hoonui i $b + a$ e me ka $i - e$.
23. E hoonui i $a - a\,b - 4$ me ka $b - 5$.
24. E hoonui i $- 6\,a$ me ka $- 6\,a$.
25. E hoonui i $12\,a\,b - 8$ me ka $a - 12$.
26. E hoonui i $- 8$ me ka $- 6$.
27. E hoonui i $8\,a\,b - 3\,w$ me ka $2\,a\,b - 5\,w$.

PAUKU IV.

Na Kumu hana o ka Hoonui.

Ua hoakakaia ma na pauku mua o keia mokuna na kumu hana e pono ai ka hoonui ana. Ma keia pauku hoi e

kakau pu ia hoi lakou i mea e maopopo lea ai na hana mahope aku nei.

1. KA HOONUI ANA. *E hoonui pu i kela hua keia hua o ke kumu hoonui me kela hua keia hua a pau o ka mea hoonui.*

2. NA KAHA. *Ina e like na kaha o ka hua kumu hoonui a me ka mea hoonui, e kauia ka + imua o ka huina: Aka ina he okoa na kaha, e kauia ka — imua o ka huina.*

3. NA HELUNA. *E hoonui pu i na heluna o kela hua o keia hua, a e kakau iho i ka huina imua o na hoailona.*

4. NA HOILONA. *E kakau iho i na hoailona o kela hua a o keia hua o kekahi mamuli iho o kekahi.*

5. KA HOOLILO. *E hui pu i kela huina me keia huina e like me na kaha e pono ai imua o ia mau mea, a e hoolilo i na mea hoailona like i hua hookahi.*

1. E hoonui i ka $m + 2\,m\,n + n$ me ka $m - n$.

Eia, $m\,m + 2\,m\,m\,n - 2\,m\,n\,n - n\,n$.

2. E hoonui i ka $m + m\,n + n$ me ka $m - m\,n + n$.

3. E hoonui i $3\,w - 2\,w\,i + 5$ me ka $w + 2\,w\,i - 3$.

4. E hoonui i $2\,a - 3\,a\,w + 4\,w$ me ka $5\,a - 6\,a\,w - 2\,w$.

5. E hoonui i ka $w + 3\,b - 6$ me ka $4\,w - 8\,b - 8$.

6. Heaha ka huina o $7\,b - 2\,m - 9$, i hoonuiia me $3\,b - 11\,m$?

7. E hoonui i $a + b + 6$ me $a - b - 6$.

8. E hoonui i $a\,b - b\,e + e\,l$ me $a\,b - b\,e - e\,l$.

9. Heaha ka huina o $5 + b - e$ i hoonuiia me $a - b + 9$.

10. Heaha ka huina o $7\,a - 3\,w + 5$, i hoonuiia me $4\,a + h$?

11. E hoonui i $b\,b - e + e\,e$ me ka $b + e$.

12. Heaha ke $3\,m\,m\,w - m\,w + w$, i hoonuiia me $2\,m - i$?

13. Heaha ka $w\,w + w\,i + 3\,k$, i hoonuiia me $w + 1$?

14. E hoonui $a + b - e$ me $1 - w$.

15. Heaha ka $a\,a - 4\,a\,w + w\,w$, me ka $a + w$?
16. Heaha ka $a\,a - 2\,a\,i + i\,i$ i hoonuiia me $a - i$?
17. E hoonui i $a + e - h$ me $4\,a\,a + 3\,e\,h$?
18. Heaha ka $m - n + p$, i hoonuiia me $5\,m\,n - 2\,i\,k$?
19. Heaha ka $16\,a\,m + 3\,a\,e$ i hoonuiia me $-a\,i + 4\,m$?
20. E hoonui i $a\,a - b\,b + 8$ me ka $m - i\,i\,i$.
21. Heaha ka $m\,m + i\,i\,i - 7$ i hoonuiia me $m - n$?
22. Heaha ka $a + b + e + h$ i hoonuiia me $a - b - e - h$?
23. E hoonui i $13\,h\,i - 12\,h$ me ka $i - 1$.
24. E hoonui i $3\,a + 5 - 2\,b$ me ka $5\,a + 2\,b - 5$.

MOKUNA V.

KA PUUNAUE.

PAUKU I.

Na mea kahi.

1. Ina e puunaue like oe i 15 na keneta na na keiki 3, ehia na keneta a kekahi? Eia, 5.

O ka mea e puunaueia ana, ua kapaia oia, *Puuokoa*: o ka mea e hoike ana i na hapa e maheleia'i ka puu, ua kapaia oia, ka *Mahele*: a o ka mea e hoike ana i kekahi hapa i maheleia'i ka puuokoa, ua kapaia hoi ia, o ka *Puuhapa*. O kela ui maluna,

o ka 15 ka puuokoa,
o ke 3 ka mahele,
a o ka 5 ka puuhapa.

No ka mea, he hana ku e o ka Puunaue i ka Hoonui, nolaila, *ina e hoonuiia ka mahele me ka puuhapa, e like auanei ka huina me ka puuokoa.* Pela no i kela ui maluna, $3 \times 5 = 15$. He pono no ke kapaia ka puuokoa he *huina hoonui*, a o ka mahele a me ka puuhapa, e kapaia laua he kumu hoonui a me ka hoonui. Ua ikea ka puuokoa a me ka mahele, a o ka hope o ka puunaue ka loaa ana o ka puuhapa.

2. $6a \div a = 6$, no ka mea, $6 \times a = 6a$.
3. $ab \div b = a$, no ka mea, $a \times b = ab$.
4. $abe \div a = be$, no ka mea, $ae \times b = abe$.
5. $abe \div b = ae$, no ka mea, $ae \times b = abe$.

6. $abe \div a = be$, no ka mea, $ab \times e = abe$.
7. $16a \div 4 = 4a$, no ka mea, $4a \times 4 = 16a$.
8. $20ab \div 5a = 4b$, no ka mea, $4b \times 5a = 20ab$.
9. $32abe \div 8ab = 4e$, no ka mea, $4e \times 8ab = 32abe$.

Ma keia mau hana ana, ua akaka ka loaa ana o ka *puuokoa*, ma ka hoonui ana i ka mahele me ka puuhapa. Penei no ia e hanaia'i, ***E mahele i ka heluna o ka puuokoa, i ka heluna o ka mahele, a o ka hoailona like o ko ka puuokoa laua o ka mahele ke kakau ole ia maloko o ka puuhapa.***

10. E puunaue i $18abmw$ i ka $9abw$.
11. E puunaue i $27abemn$ i ke $3ben$.
12. E puunaue i $9hmnp$ i ke $3hm$.
13. E puunaue i abm i ka abm.
14. E puunaue i $39ak$ i ka $13k$.
15. E puunaue i $108abehmnw$ i ka $12aemw$.
16. E puunaue i $24amnw$ i ka $12mnw$.
17. E puunaue i ke $36amn$ i ka $9amn$.
18. E puunaue i $72abemn$ i ka $8abm$.
19. E puunaue i $18hkmnw$ i ke $6hkm$.
20. E puunaue i $56amnp$ i ka $7mnp$.
21. E puunaue i a i ka b. Eia, $\frac{a}{b}$

Ma neia hana no ka like ole ana o na hua hoailona, aole e hiki ke puunaue maoli. Nolaila, *e kakau no kakou i ka mahele malalo iho o ka puuokoa me he hakina helu la.*

22. E puunaue i ka m i ka n.
23. E puunaue i ab i ka ek.
24. E puunaue i $4ab$ i ka $5mn$.
25. E puunaue i $17abw$ i ka $21ekm$.
26. E puunaue i ka ab i ka aw. Eia, $\frac{b}{w}$.

E hiki hoi ke kakau i keia $\frac{ab}{aw}$ e like mamua, a mahope e hoemi ma ka hokai ana i na hoailona like maluna a ma-

lalo, o na a ke hokaiia. Ina o $a = 4$, $b = 5$, a o ka $w = 6$, alaila $ab = 4 \times 5$, a o ka $aw = 4 \times 6$, a o ka $\frac{ab}{aw} = \frac{4 \times 5}{4 \times 6} = \frac{20}{24} = \frac{5}{6}$ e like mamua.

27. E puunaue i abe me ka abw.

28. E puunaue i $abmw$ me ka $abwi$.

29. E puunaue i abm me ka abm.

30. E puunaue i $abmn$ me ka $abmnp$.

31. E puunaue i $abmn$ me ka abm.

32. E puunaue i $bemnp$ me ka $abekn$.

33. E puunaue i $14ab$ me ka $7e$.

E kakau mua kakou i ka puunaue ana penei, $\frac{14ab}{7e}$, alaila e puunaue i na puu a elua i ka 7.

34. E puunaue i $16ab$ me ka $4w$.

35. E puunaue i $20ab$ me ka $4aw$.

36. E puunaue i $15mn$ me ka $5amn$.

37. E puunaue i $25abem$ me ka $10abw$.

38. E puunaue i $18abhm$ me ka $abhmnw$.

39. E puunaue i $21aw$ me ka $7awi$.

40. E puunaue i $5hk$ me ke $3mn$.

41. E puunaue i $14abw$ me ka $2abw$.

42. E puunaue i $abhkl$ me ka $abeomn$.

43. E puunaue i $49abenw$ me ka $7abempw$.

44. E puunaue i $abmw$ me ka $4abmn$.

45. E puunaue i $12(a - b + 9)$ me ka $8(a - b + 9)$.

46. E puunaue i $ab(19 + m - n)$ me ka $b(19 + m - n)$.

47. E puunaue i $12ab(m - n + w)$ me ke $3a(m - n + w)$.

48. E punnaue i $4(ab - 10 + w)$ me ka $7(ab - 10 + w)$.

49. E puunaue i $3(ai - 12b)$ me ka $a(ai - 12b)$.

PAUKU II.

Na kaha o ka Puunaue.

I ka mahele ana i kekahi mea me kekahi, he elua mau mea e hanaia'i. O ka mua, ka loaa ana o ka puuhapa pono ma na hoailona a me na huahelu, a o ka lua no ka hoomaopopo i ka mea io, a i ka mea io ole paha o ua puuhapa la. Ma ka pauku akahi, ua hoikeia mai ka puunaue ana i kekahi mea, me ka manao ole i na kaha. Ma keia pauku e hoikeia auanei ka loaa ana o ke kaha pono no ka puuhapa.

1. E puunaue i $a\,b$ me ka b. Eia, a.

Ma keia hana he mau mea io o ka puuokoa $a\,b$, a me ka mahele o b. No ka mea, he $+$ ke ano o ka mahele, he $+$ no hoi ka puuhapa; no ka mea, ina e hoonuiia ka mahele me ka puuhapa, e loaa no ka huina he $+\,a\,b$. Aka ina he $-\,a$ ka puuhapa, alaila $-\,a \times +\,b = -\,a\,b$. Nolaila, *o ka mea* $+$ *i puunaueia me ka mea* $+$, *e loaa no ka* $+$ *ma ka puuhapa.*

2. E puunaue i $a\,b$ me ka $-\,b$. Eia, $-\,a$.

Maanei he $-$ ka mahele o b, nolaila he $-$ no hoi ka puuhapa a; no ka mea, o ka $+\,a$ i hoonuiia me ka $-\,b = -\,a\,b$, aole $+\,a\,b$ o ka puuokoa. Nolaila, $+$ *i puunaueia e ka* $-$, *ua loaa ka* $-$ *ma ka puuhapa.*

3. E puunaue i 16 $a\,b\,m$ me ka 8 $a\,m$. Eia, 2 b.

4. E puunaue i 36 $a\,h\,m\,n\,p$ me $-$ 12 $a\,m\,n$.

5. E puunaue i 72 $a\,b\,m\,n\,w$ me ka $-$ 9 $a\,n\,w$.

6. E puunaue i $a\,b\,m$ me ka $-\,a\,b\,m$.

7. E puunaue i 12 $a\,m\,n$ me ka $-$ 4 $a\,m\,n$.

8. E puunaue i 16 $a\,b\,l\,p$ me ka $-$ 8 $a\,b\,l$.

9. E puunaue i 28 $a\,b\,m\,n\,p$ me ka $-$ 7 $a\,m\,p$.

10. E puunaue i 48 $a\,h\,k$ me ka $-$ 16 $a\,k$.

11. E puunane i $-\,a\,b$ me ka b.

Ma keia hana, he $-$ ka puuokoa $a\,b$, a he $+$ ka mahele o b, e lilo auanei ka puuhapa i $-$; no ka mea, he $-\,a \times$

$+ b = - a b$. Nolaila, *o ka mea — i puunaueia e ka mea +, ua loaa ka mea — ma ka puuhapa.*

12. E puunaue i — 16 *a m* me ka 4 *a m*. Eia, — 4.
13. E puunaue i — 21 *a b m n* me ka 7 *a m n*.
14. E puunaue i — 35 *m n w* me ka 7 *m w*.
15. E puunaue i — 32 *a b e m n* me ka 16 *a b m n*.
16. E puunaue i — *a b* me ka *a b*.
17. E puunaue i — 28 me ka 7.
18. E puunaue i — 49 *a m n* me ka 7 *a n*.
19. E puunaue i — 96 *a b e m* me ka 12 *e m*.
20. E puunaue i — 28 *a m n w* me ka 7 *a m n*.
21. E puunaue i — *a b* me ka — *b*. Eia, *a*.

Maanei, he mea — ka mahele, nolaila e lilo ka puuhapa i mea +, no ka mea, o ko laua huina hoonui, o ko ka mahele laua o ka puuhapa i hoonui pu ia, ua loaa ilaila ka puuokoa: oia $+ a \times - b$. Ina hoi he mea — ka puuhapa, alaila ua loaa ka $- a \times - b = + a b$. Aka, ua hewa ia, no ka like ole o ke kaha me ko ka puuokoa. Nolaila, *o ka mea — i puunaueia e ka mea —, ua loaa ka mea + ma ka puuhapa.*

22. E puunaue i — 18 *a b m w* me ka — 6 *a b m*. Eia, 3 *w*.
23. E puunaue i — 25 *h m n w* me ka — 5 *m*.
24. E puunaue i — 32 *a b e i* me ka — 8 *a e*.
25. E puunaue i — 45 *h k l m* me ka — 9 *k m*.
26. E puunaue i — 12 *b e* me ka — 3 *e*.
27. E puunaue i — *b e w* me ka — *b e*.
28. E puunaue i — 27 *m n* me ka — 9 *m*.
29. E puunaue i — 64 *m n* me ka — 16 *m*.
30. E puunaue i — 9 *n p w* me ka — 3 *n p w*.

Ma kela mau hana ana mamua ua loaa ia kakou keia KUMU HANA, no na kaha ma ka puunaue ana.

Ina e like na kaha imua o ka mahele a me ka puuokoa, e kauia ka + imua o ka puuhapa; ina aole e like, alaila o ka — ke kauia imua o ka puuhapa.

31. E puunaue i 18 $a\,b\,m\,n$ me ka — 9 $a\,m$.
Eia, — 2 $b\,n$.
32. E puunaue i — 64 $a\,m\,w$ me ka 8 $a\,m$.
33. E puunaue i 81 $a\,b\,e\,m\,n$ me ka 9 $a\,b\,e$.
34. E puunaue i — 63 $h\,m\,n\,p$ me ka — 7 $h\,m$.
35. E puunaue i 84 $a\,i$ me ka 12 $a\,i$.
36. E puunaue i — 27 $a\,b\,m\,n\,p$ me ka 9 $a\,b\,m$.
37. E puunaue i 42 $h\,m\,w$ me ka — 7 w.
38. E puunaue i $a\,b$ me ka $h\,k$.
39. E puunaue i a me ka — b.
40. E puunaue i — 9 $a\,w$ me ka 4 w.
41. E puunaue i 9 $p\,w$ me ka — 4 w.
42. E puunaue i — 12 $b\,e\,k$ me ke 3 $b\,e\,w$.
43. E puunaue i 18 $m\,n$ me ka — 6 $m\,w$.
44. E puunaue i 7 $m\,n$ me ka — 3 n.
45. E puunaue i — 2 $n\,p$ me ke 3 p.
46. E puunaue i — 7 $a\,b$ me ka — 3 a.
47. E puunaue i 7 $a\,b$ me ke 3 a.
48. E puunaue i — 8 $a\,b\,e$ me ke 3 $a\,b\,e$.

PAUKU III.

Na mea hui.

1. E puunaue i $a\,b + a\,e$ me ka a. Eia, $b + e$.

Ua puunaueia ka mea hui $a\,b + a\,e$ me ka mea kahi, he a. Ua puunaue mua ia ka $a\,b$ ma ka a, a he b ka puuhapa; alaila ua puunaueia ka $a\,e$ ma ka a, a he e ka puuhapa: oia hoi keia, Ua puunaue pakahi ia kela hua keia hua o ka mea hui.

2. E puunaue i 12 $a\,e + 9\,b\,e$ me ke 3 e. Eia, 4 $a + 3\,b$.
3. E puunaue i 18 $a\,m + 15$ — 21 $a\,b$ me ke 3 $a\,b$.
4. E puunaue i 3 $a\,b\,e + 12\,a\,b\,w$ — 9 $a\,b$ me ke 3 $a\,b$.
5. E puunaue i 10 $a\,w$ — 15 w me ka 5 w.

6. E puunaue i $a\,l\,w - a\,h\,w - a$ me ka $a\,w$.

7. E puunaue i $a\,w - a\,i + a\,k$ me ka a.

8. E puunaue i $6\,a\,b + 12\,a\,e$ me ke $3\,a$.

9. E puunaue i $35\,l\,n + 14\,l\,w$ me ka $7\,l$.

10. E puunaue i $12\,a\,b\,i + 6\,a\,b\,w + b\,m + 24\,b$ me ke $6\,b$.

11. E puunaue i $16\,a - 8 + 12\,i - 20\,a\,l\,w + m$ me ka 4.

12. E puunaue i $15\,a\,b - 25\,b\,w + 10\,a\,m$ me ka $10\,a$.

13. E puunaue i $28\,a\,b\,m - 14\,m - 49\,b\,m\,n$ me ka $7\,b\,m$.

14. E puunaue i $16\,a\,b - 12\,a\,e$ me ka $4\,a$.

15. E puunaue i $12\,m\,n - 18\,n$ me ke $6\,m$.

16. E puunaue i $24\,a\,b - 24\,a$ me ka $8\,a$.

17. E puunaue i $21\,a\,b - 14\,w$ me ka $-7\,a$.

18. E puunaue i $a + b - 8$ me ka a.

19. E puunaue i $15\,m\,n + 35\,w$ me ka $5\,w$.

20. E puunaue i $17 - 12\,a + a\,b$ me ke $3\,a$.

21. E puunaue i $a + b$ me ka $m + n$. Eia, $\frac{a+b}{m+n}$.

Ma keia hana, he mau mea hui o ka mahele laua o ka puuokoa: aka no ka like ole o na hua a pau, aole e hiki ke mahele maoli, e kakau nae me he mea puunaue la.

22. E puunaue i $a\,e + b\,e$ me ka $a + b$.

$$a + b)\,a\,e + b\,e\,(e$$
$$\underline{a\,e + b\,e}$$
$$* \qquad *$$

Ma keia hana e puunaue kakou i ka hua mua $a\,e$ o ka puuokoa me ka hua mua o ka mahele me a, a ua loaa ka e no ka puuhapa. Alaila, e hoonui kakou i ka mahele okoa ka $a + b$ me ka puuhapa me e, i akaka ai o ka puuhapa ia a pau, a ua loaa ka huina $a\,e + b\,e$, oia ka puuokoa. Nolaila ua akaka o ka puuhapa pono ia.

23. E puunaue i $b\,w + e\,w$ me ka $b + e$.

24. E puunaue i $a\,a + a\,b$ me ka $a + b$.

24. E puunaue i $3aa-2ab$ me ke $3a-2b$

26. E puunaue i $12aa+6ab$ me ka $4a+2b$.

27. E puunaue i $18aaa+6aab-12aaw$ me ke $6a+2b-4w$.

28. E puunaue i $14ab+21ae+49aw$ me ka $2b+3e+7w$.

29. E puunaue i $bb+3be+2ee$ me ka $b+e$.

$$b+e)\,bb+3be+2ee\,(b+2e.$$
$$\underline{bb+\ be}$$
$$2be+2ee$$
$$\underline{2be+2ee}$$
$$*\qquad *$$

Ma keia hana ana, e puunaue kakou i ka hua mua o ka puuokoa, o ka $b\,b$, me ka hua mua o ka mahele, me ka b. a ua loaa he b no ka puuhapa. Alaila e hoonui kakou i ka mahele okoa, i ka $b+e$ me ka b, a ua loaa o $b\,b+b\,e$ i huina, aole nae i like ia i ka nui me ka puuokoa. Nolaila, ua akaka, o ka b aole ia ka puuhapa a pau. Alaila, e unuhi i ka huina $b\,b+b\,e$ mailoko ae o ka puuokoa, a ua loaa $2b\,e+2e\,e$ i koena, i mea puunaue hou ia'i. Alaila, e puunaue kakou i ka hua mua o keia e like mamua, me ka hua mua o ka mahele, oia keia $\frac{2be}{b}=2e$, a oia ka hua hope o ka puuhapa. Alaila, e hoonui kakou i ka mahele $b+e$ me $2e$, a ua like ka huina $2b\,e+2e\,e$ me ke koena o ka puuokoa. A o ka $b+2e$ ka puuhapa a pau, no ka mea, ina i hoonuiia oia ma ka mahele, e like no ka huina me ka puuokoa.

30. E puunaue i $aa+2ab+bb$ me ka $a+b$.

$$a+b)\,aa+2ab+bb\,(a+b.$$
$$\underline{aa+\ ab}$$
$$ab+bb$$
$$\underline{ab+bb}$$
$$*\qquad *$$

31. E puunaue i $aa - bb$ me ka $a + b$.

$$\begin{array}{l} a+b)\,aa - bb\,(a - b \\ \quad\;\; aa + ab \\ \hline \quad\quad\;\; -ab - bb \\ \quad\quad\;\; -ab - bb \\ \hline \quad\quad\quad\;\; * \quad\; * \end{array}$$

Ua like keia hana ana me kela mamua, he okoa na mea io ole wale no. Ua loaa ke koena o ka puuokoa, $-ab - bb$, ma ka unuhi ana i $aa + ab$ mailoko aku o $aa - bb$; a o ke kaha o ka hua hope o ka puuhapa he — ia, no ka mea, aole like na kaha o ka mahele $+ a$, a o ka puuokoa $- ab$. Ua akaka hoi he oi loa ka nui o ka hua mua o ka puuhapa, o ka a; no ka mea, $(a + b)\,a = aa + ab$, a he nui loa ia, he uuku iho ka puuokoa, $aa - bb$.

32. E puunaue i $8www - nnn$ me $2w - n$.

$$\begin{array}{l} 2w - n)\,8www - nnn\,(4ww + 2wn + nn. \\ \quad\quad\;\; 8www - 4wwn \\ \hline \quad\quad\quad\quad\quad\;\; 4wwn - nnn \\ \quad\quad\quad\quad\quad\;\; 4wwn - 2wnn \\ \hline \quad\quad\quad\quad\quad\quad\quad\;\; 2wnn - nnn \\ \quad\quad\quad\quad\quad\quad\quad\;\; 2wnn - nnn \\ \hline \quad\quad\quad\quad\quad\quad\quad\quad\;\; * \quad\quad\; * \end{array}$$

PAUKU IV.

He Kumu hana no ka Puunaue.

Eia ke kumu hana i ka mea puunaue, he mau mea hui ka mahele laua o ka puuokoa.

E puunaue i ka hua mua o ka puuokoa me ka hua mua o ka mahele, i loaa'i ka hua mua o ka puuhapa.

E hoonui i ka mahele a pau me keia hua mua o ka puuhapa, a e unuhi iho i ka huina mailoko ae o ka puuokoa.

E puunaue i ka hua mua o ke koena me ka hua mua o ka mahele, i loaa'i ka hua lua o ka puuhapa.

E hoonui i ka mahele a pau me keia hua lua o ka puuhapa, a e unuhi i ka huina mailoko ae o ke koena o ka puuokoa.

Pela e hana hou aku ai a pau ae la na hua o ka puuhapa i ka loaa.

1. E puunaue i $a\,a + a\,b + a\,e + 5\,a + 5\,b + 5\,e$ me ka $a + b + e$.

2. E puunaue i $a\,a - 6\,a + a\,b - a\,e + 6\,e - b\,e$ me ka $a - e$.

3. E puunaue i $b\,b\,b + e\,e\,e$ me ka $b + e$.

4. E puunaue i $6\,m\,m\,m\,w - 3\,m\,m\,w\,i - 2\,m\,m\,w + m\,w\,i + 2\,m\,w - w\,i$ me ka $2\,m - i$.

5. E puunaue i $m\,m\,m + m\,m + m\,m\,n + m\,n + 3\,m\,w + 3\,w$ me ka $m + 1$.

6. E puunaue i $a + b - e - a\,w - b\,w + e\,w$ me ka $a + b - e$.

7. E puunaue i $a\,a\,a - 3\,a\,a\,w - 3\,a\,w\,w + w\,w\,w$ me ka $a + w$.

8. E puunaue i $a\,a\,a - 3\,a\,a\,i + 3\,a\,i\,i - i\,i\,i$ me ka $a - i$.

9. E puunaue i $4\,a\,a\,a + 3\,a\,e\,o + 4\,a\,a\,e + 3\,e\,e\,o - 4\,a\,a\,o - 3\,e\,o\,o$ me ka $a + e - o$.

10. E puunaue i $5\,m\,m\,n - 2\,m\,p\,w - 5\,m\,n\,n + 2\,n\,p\,w + 5\,m\,n\,w - 2\,p\,w\,w$ me ka $m - n + w$.

11. E puunaue i $m\,m\,m - 3\,m\,m\,n + 4\,m\,n\,n - 4\,n\,n\,n$ me ka $m\,m - 2\,m\,n + n\,n$.

$$
\begin{array}{l|l}
m\,m - 2\,m\,n + n\,n & m\,m\,m - 3\,m\,m\,n + 4\,m\,n\,n - 4\,n\,n\,n \\
\quad m\,m\,m - 2\,m\,m\,n + \;\; m\,n\,n & \left(m - n + \dfrac{m\,n\,n - 3\,n\,n\,n}{m\,m - 2\,m\,n + n\,n}\right. \\
\hline
\quad - m\,m\,n + 3\,m\,n\,n - 4\,n\,n\,n & \\
\quad - m\,m\,n + 2\,m\,n\,n - \;\; n\,n\,n & \\
\hline
\quad m\,n\,n - 3\,n\,n\,n &
\end{array}
$$

Ua hoopiliia mai ke koena o keia hana ma ka puuhapa, ma ke ano o ka hakina.

12. E puunaue i $a\,m + b\,m + a\,n + b\,n + w$ me ka $a + b$.

13. E puunaue i $e\,i - i\,h + e\,o - o\,h + w$ me ka $e - h$.

14. E puunaue i $m\,m\,m\,n - m\,m\,n\,n + 5\,m\,m\,m$ me ka $m - n$.

15. E puunaue i $3\,a\,b\,b\,b + 2\,a\,a\,b\,b\,e - a\,b\,b + b\,b\,b\,e + b\,b\,w - 3\,a\,a\,b - 2\,a\,a\,a\,e + a\,a - a\,b\,e - a\,w$, me ke $3\,a\,b + 2\,a\,a\,e - a + b\,e + w$.

16. E puunaue i $18\,a\,a\,b + 3\,a\,a\,e\,e - 3\,a\,w\,w + 3\,a\,b\,b\,e - 6\,a\,b\,b - a\,b\,e\,e + b\,w\,w - b\,b\,b\,e + a\,w + e$, me ke $6\,a\,b + a\,e\,e - w\,w + b\,b\,e$.

17. E puunaue i $-16\,a\,a\,m\,n - 3\,a\,a\,e\,n + 64\,a\,m\,m + 12\,a\,e\,m$, me ka $16\,a\,m + 3\,a\,e$.

18. E puunaue i $12\,a\,a\,b - 8\,a - 144\,a\,b + 96$ me ka $a - 12$.

MOKUNA VI.

NA HAKINA.

PAUKU I.

Na Olelo Hoakaka.

1. E puunaue like i *a* mau dala no *b* mau kanaka. Ehia mau dala ko kekahi kanaka? Eia, $\frac{a}{b}$.

E puunaueia na dala ma ka nui o na kanaka. Aka, no ka hiki ole ke puunaue maoli, e pono ke hoailonaia ka puunaue me ia maluna. Ina o $a = 3$, a o $b = 5$, e kakauia hoi ka puunaue ana e like me kela, penei, $\frac{3}{5}$.

O keia mau mea, $\frac{a}{b}$, $\frac{3}{5}$, a o na mea like e ae, ua kapaia he mau *Hakina*, no ka mea, he mau *hapa* wale no lakou, a ua kakauia ko lakou ano, *he mau hapa o ka mea okoa.* Ina e okioki kakou i ka ohia i na hapa like 5, a e haawi aku i 3 o ua mau hapa la na kekahi, ua loaa ia ia $\frac{3}{5}$ o ka ohia, a ua heluheluia ua mau huahelu la, *ekolu hapa lima*, a o *na hapalima ekolu* paha. Pela no hoi i heluheluia'i na hakina a pau: $\frac{1}{2}$, *hookahi hapalua*; $\frac{2}{5}$, *elua hapakolu*; $\frac{3}{4}$, *ekolu hapaha*; $\frac{5}{6}$, *elima hapaono*; $\frac{7}{8}$, *ehiku hapawalu*, a o *na hapahiku ewalu* paha, a pela aku.

O ka huahelu malalo o ke kaha, oia ka mea hoike i na hapa i maheleia'i ka mea okoa, a o ka puuokoa paha, ua kapaia oia, o ka Mahele.

O ka huahelu maluna o ke kaha, oia ka mea hoike i na hapa o ka mea okoa i laweia, ua kapaia oia, o ka Hoohelu.

Ma na hakina $\frac{a}{b}$, $\frac{m}{n}$, $\frac{6}{7}$, $\frac{19}{4}$, $\frac{a+b}{p+w}$, a me $\frac{3}{k}$, eia na hoohelu, a, m, 6, 19, $a+b$, a me ke 3; eia hoi na mahele, b, n, 7, 4, $p+w$, a me ke k.

Ina i uuku iho ka hakina malalo o ka mea hookahi, *he Hakina kupono* ia, oia hoi, he uuku ka hoohelu, a he nui aku ka mahele, penei, $\frac{2}{3}$, $\frac{3}{5}$, $\frac{1}{12}$, $\frac{a}{a+b}$, $\frac{m-n}{m+n}$.

Ina he oi aku ka hakina maluna o ka mea okoa hookahi, he *Hakina kuokoa* ia, penei; $\frac{3}{2}$, $\frac{14}{5}$, $\frac{49}{7}$, $\frac{a}{a}$, $\frac{ab}{a}$, $\frac{ab+b}{a}$, a pela aku.

O ka huahelu okoa e pili pu ana me ka hakina, ua kapaia oia, he *Hakinapili*, penei, $2\frac{1}{5}$, $b+\frac{b}{a}$; o ka 2, a me ka b, he mau mea okoa laua. He mea loaa pinepine ke koena mahope o ka puunaue ana, a e pono e kakauia ua koena la maluna o ka mahele ma ke ano o ka hakina, a e hoopiliia mai ia me ka puuokoa. Nolaila mai ka hakinapili.

No ka mea, he mea puunaue ke ano o ka hakina, *nolaie hoailonaia ka puuhapa o ka puunaue ana ma ke kakau ana i ka puuokoa i hoohelu, a me ka mahele i mahele hakina.*

E kakau i keia mau mea ma ke ano o na hakina.

2. E puunaue i 476 i ka 19. Eia, $\frac{476}{19}$.
3. E puunaue i 6 a b e i ka h.
4. E puunaue i 8 $a+b-w$ i ka $e-h$.
5. E puunaue i 17 $np-m+7$ i ka $w+10$.
6. E puunaue i $a-m+7-5i$ i ka $10b-w+14$.

Ina i puunaueia kekahi mea i ke 1, aole i hooloiia kona ano, nolaila, *e hiki ke hoolilo i ka mea okoa i hakina ma ke kau ana i* 1 *malalo i mahele.*

E hoolilo i keia mau mea i mau hakina.

7.) $8=\frac{8}{1}$. 8.) $a=\frac{a}{1}$. 9.) $a+b=\frac{a+b}{1}$.

10.) 24. 11.) $a-b$. 12.) $a+b-mn$.

He puuokoa no ka hoohelu o ka hakina, a he mahele puunaue hoi ka mahele o ka hakina; nolaila, ina e like ia mau mea elua, he 1 okoa no ke ano o ka hakina; penei, $\frac{3}{3}$, he mea 1 ia, no ka mea, 2 i puunaueia e ka $2 = 1$, nolaila, $\frac{1}{1}$, $\frac{2}{2}$, $\frac{3}{3}$, $\frac{4}{4}$, $\frac{5}{5}$, $\frac{a}{a}$, $\frac{ab}{ab}$, ua like pu ia mau mea, a he 1 no ke ano. Nolaila mai keia *kumu olelo. Ina i puunaueia, a i hoonuiia paha ka hoohelu, a me ka mahele o kekahi hakina, e ka huahelu hookahi, aole no e maheleia ke ano o ua hakina la.*

13. E kakau i ke 6 ma ke ano o ka hakina, o ka 4 kona mahele. Eia, $\frac{24}{4}$.

O ka hoohelu o keia hakina he 4×6, no ka mea, he puu huahelu no ia e pono ai ke puunaueia e ka 4 i loaa'i ke 6 i puuhapa.

14. Ua haawiia mai ka w e kakauia'i ma ke ano o ka hakina, o ka i kona mahele. Eia, $\frac{wi}{i}$

E hoolilo mua kakou i ka w i hakina penei, $\frac{w}{1}$, alaila, e hoonui i kela hua i keia hua me ka i, e like me kela kumu olelo maluna. Ina makemake kakou e hoolilo i ka mea okoa i hakina, *E hoonui kakou i ka mea okoa me ka mahele i haawiia mai, a e kau iho i ka huina maluna o ka mahele i hoohelu.*

15. E hoolilo i ka 8 i hakina, he 5 kona mahele.

16. E hoolilo i $a + b$ i hakina, o ka e kona mahele.

17. E hoolilo i $m + n$ i hakina, he 5 w kona mahele.

18. E hoolilo i $a - 5$ i hakina, he $2 + b$ kona mahele.

19. E hoolilo i $5a - be$ i hakina, he 4 w kona mahele.

20. E hoolilo i $w + b - 5$ i hakina, he $3a - k$ kona mahele.

21. E hoolilo i $5a - 2 + i$ i hakina, he 6 kona mahele.

22. E hoolilo i $28 - m + 4w$ i hakina, he $2a$ kona mahele.

23. E hoolilo i $2ab + w - 5$ i hakina, he $5ab$ kona mahele.

PAUKU II.

No ka Hoolilo.

He mea pono no i kekahi manawa ke hoolilo i ke ano o ka Hakina. No ka mea, ina e manao kakou e hoomakaukau i na hakina ano e no ka houluulu pu ia, o ka pono no e hoolilo ia mau mea ano e, i mau hakina mahele like. Ua kapaia keia hana ana, *he Hoolilo.*

I. *O ka hoolilo i ka hakina kuokoa i hakinapili.*

1. Heaha ke kumu o $\frac{8}{8}$? Eia, 1.

2. Heaha ke kumu o $\frac{19}{5}$? Eia, $3\frac{4}{5}$.

No ka mea, ua like $\frac{5}{5}$ me ke 1, he 19 hapa 5, ua like ia me 3 a me 4 hapa 5 hou aku.

3. Heaha ke kumu o $\frac{ab}{a}$? Eia, b.

4. Heaha ke kumu o $\frac{ab+b}{a}$? Eia, $b + \frac{b}{a}$.

No ka hoolilo i ka hakina kuokoa, i mea okoa, a i hakinapili paha, *E puunaue i ka hoohelu me ka mahele, o ka puuhapa ka mea okoa, a ina he koena, oia ke hoopiliia mai ma ke ano o ka hakina.*

E hoolilo i neia mau hakina i mea okoa, a i hakinapili paha.

5.) $\frac{17}{3}$. 6.) $\frac{24}{3}$. 7.) $\frac{39}{4}$. 8.) $\frac{127}{8}$.

9.) $\frac{a}{a}$. 10.) $\frac{5ab}{b}$. 11.) $\frac{a+b}{a+b}$. 12.) $\frac{18mn}{6m}$.

13. Heaha ke kumu $\frac{4ab-bb}{a}$?

14. Heaha ke kumu o $\frac{aaa-bbb}{a-b}$?

15. E hoolilo i $\frac{a+b}{a-b}$ i hakinapili.

II. *No ka hoolilo ana i ka Hakinapili i hakina kuokoa.*

16. E hoolilo i $7\frac{2}{3}$ i hakina kuokoa. Eia, $\frac{23}{3}$.

Iloko o ke 1, 3 hapakolu; iloko o ka 7, 7 kolu, oia he 21 hapa 3, a me 2 hapa 3 hou aku, he 23 hapa 3.

17. E hoolilo i $b + \frac{b}{a}$ i hakina kuokoa. Eia, $\frac{ab+b}{a}$.

Ina e hooliloia ka mea okoa o b i hakina, ua lilo ia i $\frac{ab}{a}$; a o ka hakina a pau, oia no keia, $\frac{ab}{a} + \frac{b}{a}$, oia hoi $\frac{ab+b}{a}$.

Nolaila, no ka hoolilo i ka hakinapili i hakina kuokoa, *E hoonui i ka mea okoa me ka mahele o ka hakina, a e hui mai i ka hoohelu me ka huina hoonui: alaila e kakau i ua huina la i hoohelu maluna o ka mahele.*

E hoolilo i neia mau hakinapili i mau hakina kuokoa.

18.) $9\frac{1}{7}$. 19.) $a + \frac{a}{b}$. 20.) $mn + 10 + \frac{m}{n}$.

21.) $b + \frac{a}{a+b}$. 22.) $a - w + \frac{a}{a-w}$. 23.) $aa + \frac{bb}{aa}$.

24.) $a - 12 + b + \frac{w}{a-b}$. 25.) $m - n + b + \frac{m-n}{b+14}$.

26. E hoolilo i $a + b + \frac{a}{a+b}$ i hakina kuokoa.

27. E hoolilo i $a + \frac{a+b}{a-b}$ i hakina kuokoa.

III. *No ka hoolilo i na hakina i mahele hookahi.*

28. E hoolilo i $\frac{3}{4}$ $\frac{2}{5}$ i mahele hookahi. Eia, $\frac{15}{20}$ a me $\frac{8}{20}$.

Maanei e imi ana kakou i elua mau hakina hou e like ana ko laua kumu me $\frac{3}{4}$ a me $\frac{2}{5}$, me ka mahele hookahi no laua. Ina e hoonuiia na hua a elua o ka hakina mua me ka mahele o ka hakina hope, ua lilo ia i $\frac{15}{20}$; a ina e hoonuiia na hua o ka hakina mahope me ka mahele o ka hakina mua, ua lilo hoi ia i $\frac{8}{20}$.

29. E hoolilo i $\frac{1}{2}$, $\frac{2}{3}$, $\frac{3}{4}$ i mau hakina mahele hookahi.

Eia, $\frac{1}{2} = \frac{12}{24}$, $\frac{2}{3} = \frac{16}{24}$, a o $\frac{3}{4} = \frac{18}{24}$.

30. E hoolilo i $\frac{a}{b}$ a me $\frac{m}{n}$ i mahele hookahi.

Eia, $\frac{a}{b} = \frac{an}{bn}$, a o $\frac{m}{n} = \frac{bm}{bn}$.

Eia ke kumu hana e hoolilo ai i na hakina mea mahele okoa, i mau hakina mahele hookahi, me ka hololi ole i ko lakou kumu.

No na hoohelu hou; *E hoonui i kela hoohelu keia hoo-*

helu me na mahele o na hakina okoa a pau e kau pu ana, aole me kona iho.

No ka mahele hookahi; *E hoonui pu i na mahele a pau i mahele hookahi.*

31. E hoolilo i $\frac{1}{3}$, $\frac{2}{5}$, a me $\frac{7}{8}$ i mahele hookahi.

32. E hoolilo i $\frac{a}{b}$, $\frac{e}{h}$ a me $\frac{i}{k}$ i mahele hookahi.

33. E hoolilo i $\frac{3w}{a}$ a me $\frac{i}{5b}$ i mahele hookahi.

34. E hoolilo i $\frac{a}{b}$, $\frac{b}{e}$ a me $\frac{e}{a}$ i mahele hookahi.

35. E hoolilo i $\frac{3w}{a}$, $\frac{2b}{5e}$, a me u i mahele hookahi.

36. E hoolilo i $\frac{5}{6}$, $\frac{a}{b}$, a me $\frac{a+e}{h}$ i mahele hookahi.

37. E hoolilo i $\frac{a}{5}$, me $\frac{3}{2k}$ i mahele hookahi.

38. E hoolilo i w, $\frac{3i}{k}$, a me 8 i mahele hookahi.

IV. *No ka hoolilo i na hakina ilalo loa.*

No ka hiki wawe o ka hana ana i na hakina liilii, ua haawiia mai keia kumu e hoolilo ai i na hakina nui ilalo loa, me ka hoololi ole i ko lakou kumu.

E puunaue i ka hoohelu a me ka mahele me ka huahelu hookahi e pono ai ke mahele iho me ke koena ole mahope.

E hoolilo i keia mau hakina ilalo loa;

39.) $\frac{127}{635} = \frac{1}{5}$. 40.) $\frac{ab}{aaw} = \frac{b}{aw}$. 41.) $\frac{3aw}{3awh} = \frac{1}{h}$.

42.) $\frac{am+an}{ab+am} = \frac{m+n}{b+m}$. 43.) $\frac{13a}{39w}$.

44.) $\frac{3mn}{9am+27mn}$. 45.) $\frac{2aab-4aam}{6aaa+10aan}$.

46.) $\frac{24aa-12}{16am+20}$. 47.) $\frac{8amn-4an+16aan}{12amn-20an+24amnw}$.

48. E hoolilo i $\frac{am+bn-mn}{an+en+am}$ ilalo loa.

49. E hoolilo i $\frac{5ab-10am+15an}{20am-10ak+5ab}$ ilalo loa.

PAUKU III.

Na Kaha o na Hakina.

Pono e manao ka haumana i ka hoohelu me he puuokoa la ke ano ma ka puunaue ana, a o ka mahele hakina, he mahele puunaue no ia: a o ke kumu o ka hakina, ua loaa ia ma ka puuhapa mahope o ka puunaue ana. Ina i kauia ke kaha mamua o kekahi hua, no kela hua wale no ia; aka, ina i kauia ke kaha imua pono o ka hakina, ua kohu ka hakina okoa ilaila. Ina aole i kauia ke kaha imua o ka $\frac{a\,b}{a}$, ua akaka kona kumu, he b. Ma ke kau mua ana i na kaha, ua loaa mai keia mau hana.

$$\frac{+ab}{+a} = +b. \qquad \frac{-ab}{-a} = +b.$$

$$\frac{-ab}{+a} = -b. \qquad \frac{+ab}{-a} = -b.$$

Nolaila, *ina e hooloiia'e na kaha a elua, i ko ka hoohelu a me ko ka mahele, aole nae e ano e ke kumu o ka hakina ilaila; aka, ina i hooloiia kekahi kaha wale no o laua, alaila e hooloiia'e ke kumu o ka hakina.*

1. E hoolilo i $7\,b - \frac{e-h}{2\,a}$ i hakina kuokoa.

Eia, $\frac{14\,ab - e + h}{2\,a}$.

I keia hana ana, o ke kumu o ka hakina $\frac{e-h}{2\,a}$, oia ka mea unuhi mailoko ae o ka mea okoa, o ka $7\,b$. No ka mea, o ke kaha — i kauia mamua o ka hakina, aole ia e pili i ka hua mua o ka hoohelu, aole hoi i ka mahele, aka, ua pili no ia i ke kumu o ka hakina. Ina e hoolilo kakou i ka $7\,b$ i ano hakina, ua loaa keia mea, $\frac{14\,ab}{2\,a} - \frac{e-h}{2\,a}$. Alaila, e waiho kakou i ka mahele $2\,a$, a e unuhi i ka hoohelu, $e - h$, mailoko ae o ka $14\,a\,b$, e like me ka unuhi ana i na mea okoa: a ua loaa ka $14\,a\,b - e + h$. A o ka hoi-

hoi wale mai no i ka mahele i waihoia ka hana e koe, a ua loaa ka $\frac{14ab-e+h}{2a}$.

2. E hoolilo i $7b-\frac{e+h}{2a}$ i hakina kuokoa.

Eia, $\frac{14ab-e-h}{2a}$.

3. E hoolilo i $7b+\frac{e-h}{2a}$ i hakina kuokoa.

Eia, $\frac{14ab+e-h}{2a}$.

4. E hoolilo i $7b+\frac{e+h}{2a}$ i hakina kuokoa.

Eia, $\frac{14ab+e+h}{2a}$.

Ma keia mau haawina, o ke 3 a me ka 4, aole i hoololiia na kaha imua o na hakina $\frac{e-h}{2a}$, a me $\frac{e+h}{2a}$, no ka mea, e huiia aku laua me ka $7b$.

5. E hoolilo i $3a-\frac{a+b}{e}$ i hakina kuokoa.

6. E hoolilo i $mn-\frac{b-7}{8}$ i hakina kuokoa.

7. E hoolilo i $ab+\frac{14-n}{3m}$ i hakina kuokoa.

8. E hoolilo i $8bw+\frac{5m+n}{4a}$ i hakina kuokoa.

9. E hoolilo i $9m-\frac{6n-12w}{3a}$ i hakina kuokoa.

10. E hoolilo i $m+\frac{a-b}{m-n}$ i hakina kuokoa.

PAUKU IV.

Houluulu.

1. Heaha ka huina o $\frac{2a}{e}$ a me $\frac{3a}{e}$? Eia, $\frac{5a}{e}$

He mahele hookahi ko keia mau hakina elua, nolaila o ka hookui ana i ko laua mau hoohelu ka pono, penei, $3a+2a=5a$. Ina o ka $a=4$ a me ka $e=2$, alaila $\frac{2a}{e}$

$= \frac{8}{2}$, oia he 4; a o ke $\frac{3a}{e} = \frac{12}{2} = 6$: a o ka $4 + 6 = 10$. Aka $\frac{5a}{e} = \frac{20}{2} = 10$ no hoi.

2. E hui pu i $\frac{3a}{e}, \frac{5a}{e}, \frac{6a}{e}$, a me $\frac{a}{e}$.

3. Heaha ka huina o $\frac{a+b}{m-n}, \frac{3a+2b}{m-n}$, a me $\frac{4a-6b}{m-n}$?

4. E houluulu i $\frac{m-n+w}{2ab}, \frac{2n-w-3m}{2ab}$, me $\frac{2m-n+w}{2ab}$.

5. Heaha ka huina o $\frac{a}{e}$ me $\frac{b}{e}$? Eia, $\frac{a+b}{e}$.

He mahele hookahi o keia mau hakina elua, aka, he like ole na hoohelu; nolaila e houluuluia'i laua ma ke kaha + wale no. Ina like ka a me 4, a o $b = 6$, a o $e = 2$; alaila $\left(\frac{a}{e} + \frac{b}{e}\right) = \left(\frac{4}{2} + \frac{6}{2}\right) = 2 + 3 = 5$: pela hoi $\frac{a+b}{e} = \frac{4+6}{2} = \frac{10}{2} = 5$ no hoi.

6. Heaha ka huina o $\frac{a}{w}, \frac{b}{w}, \frac{e}{w}$, a me $\frac{2i}{w}$?

7. E houluulu i $\frac{2a}{m-n}, \frac{3b}{m-n}, \frac{3a}{m-n}$, a me $\frac{e}{m-n}$.

8. E houluulu i $\frac{3a-b}{m+7-w}, \frac{e+2b}{m+7-w}$, a me $\frac{a-e-b}{m+7-w}$.

9. Heaha ka huina o $\frac{a-7+2e}{m+n}, \frac{3b+13+e}{m+n}$ me $\frac{m-4b-10-3e}{m+n}$?

10. Heaha ka huina o $\frac{a}{b}$ a me $\frac{e}{i}$? Eia, $\frac{ai+be}{bi}$?

No ka mea, he mau mahele okoa ko keia mau hakina, ua hui pu ia laua ma ka +; e hoililoia laua i mahele hookahi, e kau ana i ka + mawaena.

Eia ke kumu hana no ka houluulu hakina: *E hoolilo i na hakina mahele okoa i mahele hookahi; e hookui i na hoohelu, a e kau i ka huina, i hoohelu hou maluna o ka mahele hou.*

11. E houluulu i $\frac{5a}{be}, \frac{3e}{be}$ a me $\frac{4b}{ei}$.

$$\left.\begin{array}{l} \frac{5a}{be} \times b \times ei = 5abei \\ \frac{3e}{be} = \frac{3}{b} \times be \times ei = 3beei \\ \frac{4b}{ei} \times be \times b = 4bbbe \end{array}\right\} \text{na hoohelu.}$$

$$\frac{4b}{ei} \times be \times b = bbeei \quad \text{ka mahele.}$$

Nolaila, $\frac{5a}{be} = \frac{5abei}{bbeei} = \frac{5ai}{bei}$;

$$\frac{3e}{be} = \frac{3beei}{bbeei} = \frac{3ei}{bei};$$

$$\frac{4b}{ei} = \frac{4bbbe}{bbeei} = \frac{4bb}{bei}.$$

Ua hoemiia ua mau hakina la ilalo loa ma ka puunaue ana ia lakou i ka $b\ e$. Eia ka huina, $\frac{5ai+3ei+4bb}{bei}$.

12. E houluulu i $\frac{3a}{2b}$, $\frac{4a}{3i}$ a me $\frac{5a}{4be}$.

13. E houluulu i $\frac{4a}{b}$, $\frac{5b}{e}$, a me $\frac{6e}{a}$.

14. E houluulu i $\frac{a+b}{5}$ me $\frac{2a+6}{8}$.

15. E houluulu i $a + \frac{m+n}{3}$ me $5\,a + \frac{3m+n}{7}$.

16. Heaha ka huina o $6\,m$, $\frac{7m}{a}$, 5, a me $\frac{3m+2}{4}$?

17. E houluulu i $\frac{4m}{a}$, $\frac{7m+1}{6}$, $\frac{3m+5}{b}$ a me $2\,m + n$.

18. E houluulu i $m - \frac{3a-2}{w}$, $3\,m - \frac{4a+7}{b}$, me $b + \frac{a-b}{m}$.

19. E houluulu i $a\,b$, 15, $\frac{m+n}{e}$ me $\frac{6}{7}$.

20. E houluulu i $\frac{a}{b}$, $\frac{e}{i}$, $4\,m$ a me $\frac{5}{6}$.

22. E houluulu i $\frac{1}{2}\,m$ a me $\frac{3}{4}\,m$. Eia, $\frac{5m}{4}$.

Ua like ke ano o ka $\frac{1}{2}\,m$ me ka $\frac{m}{2}$, a ua like hoi $\frac{3}{4}\,m$ me $\frac{3m}{4}$; a $\frac{m}{2} + \frac{3m}{4} = \frac{5m}{4}$, oia $1\frac{1}{4}\,m$.

22. E houluulu i $\frac{1}{2}\,m$, $\frac{2}{3}\,m$, $\frac{3}{4}\,m$ a me $\frac{5}{8}\,m$.

23. Heaha ka huina o $\frac{1}{4}\,a$, $\frac{2}{3}\,a$, me $\frac{1}{2}\,a$?

24. E houluulu i $\frac{2}{3}\,a\,b$, $\frac{5}{8}\,a\,b$, $\frac{3}{8}\,a\,b$, $\frac{1}{4}\,a\,b$, a me $\frac{5}{8}\,a\,b$.

25. E houluulu i $\frac{2}{3}\,(a - m)$, $\frac{3}{4}\,(a - m)$, a me $\frac{1}{2}\,(a - m)$.

PAUKU V.

Ka Unuhi ana.

Ua like ke kakau ana i ka unuhi me ka houluulu, aka, *e hoololiia na kaha imua o na hua e unuhiia.*

1. E unuhi i $\frac{3mn}{a}$ mailoko ae o $\frac{5mn}{a}$. Eia, $\frac{2mn}{a}$.
2. E unuhi i $\frac{m}{n}$ mailoko ae o $\frac{w}{n}$.
3. E unuhi i $\frac{a}{b}$ mailoko o ka $\frac{e}{i}$.
4. E unuhi i $\frac{4am}{w}$ mailoko o ka $\frac{3be}{5n}$.
5. E unuhi i $m + \frac{n-7}{4}$ mailoko o $3w + \frac{a-b}{e}$.
6. E unuhi i $\frac{3a+5}{8}$ mailoko o $\frac{7a}{2}$.
7. E unuhi i $\frac{4m+3}{m-1}$ mailoko o $\frac{6m-2}{m+1}$.
8. E unuhi i $\frac{1}{a+b}$ mailoko o $\frac{1}{a-b}$.
9. E unuhi i $\frac{m+n}{a}$ mailoko o $m - \frac{3-n}{b}$.
10. E unuhi i $6a - \frac{a+b}{7}$ mailoko o $9a - \frac{a-6}{4}$.
11. E unuhi i $3n$ mailoko o $m - \frac{a+b}{4}$.
12. E unuhi i $4n$ mailoko o $5n - \frac{m-8mn}{w}$.
13. E unuhi i $\frac{2m-n}{4}$ mailoko o $\frac{8m+p}{w}$.
14. Noloko o $\frac{6}{a+m}$ e lawe i $\frac{a-m}{6}$
15. E lawe i $\frac{4w}{a}$ mailoko o $\frac{m}{5}$.
16. Noloko o $5am$ e lawe i $\frac{3m}{7}$.
17. Noloko o $a+b$ e lawe i $\frac{3w}{7}$.
18. E lawe i $a - \frac{4+a}{3}$ mailoko o $m - n$.
19. E unuhi i $a - b$ mailoko o $\frac{27m}{a+b}$.

PAUKU VI.

Ka Hoonui ana.

Ina e haawi pakahi aku kekahi i $\frac{1}{4}$ o ke dala na na kanaka ekolu, heaha ka huina o ia mau hapaha?

Eia, $\frac{3}{4}$ o ke dala.

No ka mea, $\frac{1}{4} + \frac{1}{4} + \frac{1}{4}$, oia $\frac{1}{4} \times 3 = \frac{3}{4}$. Ina e hoailona kakou ia mea $\frac{a}{b} = \frac{1}{4}$ a o e = na kanaka 3, alaila, $\frac{a}{b} \times e = \frac{ae}{b}$. Eia ke kumu hana, *E hoonui i ka hoohelu o ka hakina ma ka mea okoa.*

2. E hoonui i $\frac{3a}{2be}$ me 4 w. Eia, $\frac{6aw}{be}$.
3. E hoonui i $\frac{a+b}{7w}$ me 4 pw.
4. E hoonui i $\frac{a-2}{b+e}$ me $w - 2$.
5. E hoonui i $\frac{4ab-6}{5w}$ me 5 pw.
6. E hoonui i $\frac{8aw-4b}{5p}$ me $-a$ w.
7. E hoonui i $\frac{a}{2b}$ me b. Eia, $\frac{a}{2}$

Ma keia haawina, aole e hoonuiia ka hoohelu, aka ua puunaueia ka mahele. *Ina e hiki ke puunaue pono i ka mahele, aohe mea e koe, oia no ka hoonui i ka hakina me ka mea okoa: aka, ina he koena, alaila, pono e hoonui i ka hoohelu.*

Aia hoonuiia kekahi hakina me ka mea e hookahi ana me ka mahele, alaila, ua like ka hua i loaa me ka hoohelu o ka hakina: no ka mea, ilaila ua puunaueia a ua hoonuiia hoi ka hoohelu me ka mea hookahi. Penei: $\frac{1}{2} \times 2 = 1$. $\frac{3}{4} \times 4 = 3$. $\frac{a}{b} \times b = a$. $\frac{m-n}{a+3} \times a + 3 = m - n$.

8. E hoonui i $\frac{3}{8}$ me ka 4. Eia, $\frac{3}{2} = 1\frac{1}{2}$.
9. E hoonui i $\frac{mn}{4bm}$ me $2b$. Eia, $\frac{mn}{2m} = \frac{n}{2}$.
10. E hoonui i $\frac{3a-b}{21m+14n}$ me ka 7.

11. E hoonui i $\frac{8+a}{15\,b-10\,b\,m}$ me ka 5 *b*.

12. E hoonui i $\frac{a-m}{m\,n-2\,m}$ me ka — *m*.

13. E hoonui i $\frac{a}{b}$ me ka $\frac{e}{i}$. Eia, $\frac{a\,e}{b\,i}$.

Ina e hoonui kakou i $\frac{a}{b}$ me ka $\frac{e}{1}$ oia ka *e*, ua loa $\frac{a\,e}{b}$; aka, o *e* i puunaueia i ka *i* ka mea hoonui; nolaila, ua nui loa kela loaa ana: a ua pono ke puunaueia oia e ka *i*. Nolaila, ina e hoonui kakou i ka hakina me ka hakina, *E hoonui pu i na hoohelu i hoohelu hou, a e hoonui pu i na mahele i mahele hou.*

Pela no hoi e ikeia'i ka hakina o ka hakina; penei, $\frac{1}{2}$ o $\frac{3}{4}$ he $\frac{3}{8}$ ia: a $\frac{1}{3}$ o $\frac{2}{5}$ he $\frac{2}{15}$ ia.

14. E hoonui i $\frac{2\,e}{a\,b}$ me $\frac{3\,a}{2\,w}$.

15. E hoonui i $\frac{a+w}{n}$ me $\frac{3\,m}{4}$.

16. E hoonui i $\frac{a-b}{w}$ me $\frac{w}{b-4}$.

17. E hoonui i $\frac{a+b}{3+p}$ me $\frac{w-1}{m+5}$.

18. E hoonui i $\frac{a\,i-3}{4}$ me $\frac{b\,e}{a-w}$.

19. E hoonui i $\frac{a\,m\,n}{b-8}$ me $\frac{b-8}{a\,m\,n}$.

20. E hoonui i $\frac{3\,a\,m-w}{2}$ me $\frac{3\,a}{p-w}$.

PAUKU VII.

Ka Puunaue ana.

1. Ua puunaue like kekahi i $\frac{3}{4}$ o ke dala na na keiki 3. Heaha ka kekahi? Eia, $\frac{1}{4}$ o ke dala.

O ka hapakolu o na mea okoa ekolu, he mea okoa hookahi ia: pela hoi $\frac{1}{3}$ o na hapa 4 ekolu, he $\frac{1}{4}$ ia, penei $\frac{3}{4} \div 3 = \frac{1}{4}$, a ina $\frac{a\,e}{b}$ dala i puunaue like ia na na *e* kanaka, e lilo na ka

mea hookahi $\frac{a\,e}{b} \div e = \frac{a}{b}$ dala. Ma keia hana ke puunaue nei kakou i ka hoohelu ma ka mea okoa.

2. E puunaue i $\frac{3\,a\,b}{w}$ i 3 a. Eia, $\frac{b}{w}$.

3. E puunaue i $\frac{m+n}{b\,e}$ i $m+n$.

4. E puunaue i $\frac{8\,m\,n}{b-e}$ i 4 n.

5. E puunaue i $\frac{14\,a}{3\,m\,n}$ i ka 7.

6. E puunaue i $\frac{16\,a-8\,a}{a+2\,m}$ i 4 a.

7. Ua puunaue like kekahi i ka $\frac{1}{2}$ o ke dala na na kanaka 2. Heaha ka kekahi? Eia, $\frac{1}{4}$ o ke dala.

He hapalua o ka haawina ka kekahi, a he $\frac{1}{2}$ o ka $\frac{1}{2}$, oia ka $\frac{1}{4}$. Maanei ua hoonuiia ka mahele e ka mea okoa. $\frac{1}{2} \times 2 = \frac{1}{4}$. *Ina e hiki ke puunaue koena ole i ka hoohelu, pela e puunaueia'i ka hakina. Ina aole ia e hiki, alaila, e pono ke hoonui i ka mahele.*

8. E puunaue i $\frac{a\,b}{e}$ i ka b. Eia, $\frac{a}{e}$.

9. E puunaue i $\frac{3\,m\,n}{b-e}$ i 3 w.

10. E puunaue i $\frac{32\,w-8\,b\,w}{a+8}$ i 8 w.

11. E puunaue i $\frac{7\,a\,w}{m-n}$ i 3 b.

12. E puunaue i $\frac{2\,m-n}{p}$ i 3 w.

13. E puunaue i $\frac{3\,b-32\,m\,n}{w+8}$ i ka 4.

14. E puunaue i $\frac{3}{10}$ i $\frac{3}{10}$. Eia, 3.

Hookahi no mahele o keia mau hakina elua, a ua puunaueia ka hoohelu o kekahi e ka hoohelu o kekahi. He maopopo, ua pa 3 ekolu hapa 10 iloko o $\frac{3}{10}$.

15. E puunaue i $\frac{a}{b}$ i $\frac{e}{i}$. Eia, $\frac{a\,i}{b\,e}$.

E hoolilo mua kakou i na hakina i ka mahele hookahi, penei, $\frac{a}{b} = \frac{a\,i}{b\,i}$, a $\frac{e}{i} = \frac{b\,e}{b\,i}$. Alaila e puunaue i ka hoo-

helu o kekahi me ka hoohelu o kekahi, a ua loaa o $\frac{ai}{be}$. Aka ina e hoonui kakou i ka hoohelu o ka puuokoa me ka mahele o ka hakina hoomahele; a e hoonui hoi i ka mahele o ka hakina hoomahele me ka hoohelu, ua like no ka mea i loaa; penei, $\frac{a}{b} \times \frac{i}{e} = \frac{ai}{be}$.

Nolaila, Penei e puunaue ai kekahi hakina i kekahi hakina, *E hoololi i ka mahele maluna, a i ka hoohelu malalo o ke kaha, alaila, e hoolike i ka hana ana me ko ka hoonui.*

16. E puunaue i $\frac{2a}{3m}$ i $\frac{b}{2w}$.

17. E puunaue i $\frac{3a-b}{e}$ i $\frac{b}{m-n}$.

18. E puunaue i $\frac{3(a-b)}{mn}$ i $\frac{w(a+b)}{mn}$.

19. E puunaue i $\frac{4ab}{w(a+3)}$ i $\frac{pw}{3(8m-n)}$.

20. E puunaue i $\frac{a+b}{m-n}$ i $\frac{3-a}{w+4}$.

21. E puunaue i $\frac{8w-a}{m+n}$ i aw.

22. E puunaue i mn i $\frac{4mn-16w}{8a-12}$.

23. E puunaue i $\frac{-m}{n}$ i $\frac{a}{-b}$.

24. E puunaue i $\frac{-m}{n}$ i $\frac{-a}{b}$.

25. E puunaue i $\frac{3a}{b}$ i $\frac{m}{3}$.

26. E puunaue i $\frac{m-n}{a}$ i $\frac{a-b}{m}$.

MOKUNA VII.

NA PAPA.

PAUKU I.

1. Heaha ka huina o $a\,a$ i hoonuiia me ka a?

Eia, a^3.

O ka huina i loaa ma keia hana, eia no ia, $a\,a\,a$. No ka pono ole e kakau pakolu i ka a, ua hoailonaia kona pakolu ana ma ka huahelu iki ^{3} e kau ana maluna ma ka akau o ka a. Ua kapaia keia hoailona, he *Hoailona Papa*: no ka mea, *ua hoike no ia i na hoonui papa ana o kekahi hua me ia hua hookahi no.* Ina aole i kauia ka Hoailona ma ka akau, alaila, he 1 no ka hoailona ma ke ano; a o ka hua i palapalaia, oia ka *papa mua*, a o ke *kumu* hoi o ka hana ana: penei,

a = ka papa mua;
$a \times a = a^2$ = ka papa 2;
$a \times a \times a = a^3$ = ka papa 3;
$a \times a \times a \times a = a^4$ = ka papa 4; a pela aku.

Ina e hoolike kakou i ka a me ke 3, alaila,

a = 3 ka papa mua,
$a^2 = 3^2$, oia $3 \times 3 = 9$ ka papa alua,
$a^3 = 3^3$, oia $3 \times 3 \times 3 = 27$ ka papa akolu,
$a^4 = 3^4$, oia $3 \times 3 \times 3 \times 3 = 81$ ka papa ha, a pela aku.

He mea okoa ka *heluna* i kakauia imua o kekahi hua, a he okoa hoi ka *papa* e kau ana maluna ma ka akau. Mai

noho a hoolike ia laua. No ka mea, ina e kapa kakou o ka m, he 6 ia;

alaila, $5\,m = 5 \times 6 = 30$;

aka, $m^5 = 6 \times 6 \times 6 \times 6 \times 6 = 7776$.

Nolaila, ua akaka, *ua hookiekieia'e kekahi hua hookahi iluna i kekahi papa i makemakeia, ma ke kau ana ia hua a me ka hoailona o ia papa.*

2. Heaha ka papa 2 o ka w? ka papa 4 o ka i? ka papa 5 o ka e? ka papa 8 o ka a? ka papa 7 o ka m?

3. Heaha ka hua ana o $a\,b$ i hoonuiia me ka $a\,b$; oia hoi o ka papa 2 o $a\,b$?

$$a\,b \times a\,b = a\,a\,b\,b, \text{ oia } a^2\,b^2.$$

Ma neia wahi, o ka mea e hookiekieia'e, he mau hua elua no iloko, he a, a me b; *a ua kauia ka hoailona o ka papa 2 maluna o ka akau o kela hua a o keia hua.*

4. Heaha ka papa 4 o $m\,n$?

5. E hookiekie i $a\,b\,e$ i ka papa 6.

6. Heaha ka papa 9 o $a\,b\,m$?

7. E hoonui i $m\,n\,w$ a hiki i ka papa 7.

8. Heaha ka papa 2 o 4 $a\,b$? Eia, $16\,a^2\,b^2$.

O ka papa 2 o kekahi hua, *oia ka hua ana o ka hua i hoonuiia me ia hua hookahi no;* nolaila, o ka papa 2 o ka $4\,a\,b \times 4\,a\,b = 16\,a\,a\,b\,b = 16\,a^2\,b^2$.

Nolaila, *e hiki ke hookiekie i na heluna i kekahi papa maluna, ma ka hoonui ana o ia mea me ia hua iho no.*

9. Heaha ka papa 3 o 5 $a\,w$?

10. Heaha ka papa 4 o 7 $a\,b\,e$?

11. E hookiekie i 6 $m\,n\,w$ i ka papa 5.

12. Heaha ka papa 4 o $-2\,a\,b\,e$?

$$\begin{array}{l} -2\,a\,b\,e \\ -2\,a\,b\,e \\ \hline +4\,a^2\,b^2\,e^2, \text{ ka papa 2.} \\ -2\,a\,b\,e \\ \hline -8\,a^3\,b^3\,e^3, \text{ ka papa 3.} \\ -2\,a\,b\,e \\ \hline +16\,a^4\,b^4\,e^4 \text{ ka papa 4.} \end{array}$$

Ma keia hana, ua akaka, *ina he mea io ole ke kumu o ka papa mua, alaila, he mea io ka papa* 2, *he io ole ka papa* 3, *he mea io hoi ka papa* 4, *a pela aku.*

13. Heaha ka papa 2 o a^3?

Ma keia hoi, he papa 3 ka haawina o a^3; nolaila, ua hoonuiia ka hoike o ka haawina me ka hoike o ka papa i manaoia, penei, $a^{3\times 2} = a^6$; no ka mea, $a^3 = a\,a\,a$, a o ka $a\,a\,a \times a\,a\,a = a^6$.

14. Heaha ka papa 3 o $a\,b^3$? Eia, $a^3\,b^9$.

15. Heaha ka papa 2 o $a^3\,b\,w^2$?

16. E hookiekie ae i $a^2\,b^3\,w$ i 3 papa.

17. Heaha ka papa 3 o $m^2\,n^3\,p^2\,w$?

18. E hookiekie ae i 6 $a^2\,e^3\,m^4$ i 2 papa.

19. Heaha ka papa 3 o 3 $m^2\,n^3\,w^4$?

20. Heaha ka papa 4 o 4 $a^2\,m^3\,n_2\,w$?

PAUKU II.

Ka hookiekie ana o na mea hui.

1. E hookiekie i ka mea hui i $a + b$ i ka papa 5.

$a + b$, papa 1
$a + b$

$a^2 + a\,b$
$\quad a\,b + b^2$.

$a^2 + 2\,a\,b + b^2$, ka papa 2
$a + b$

$a^3 + 2\,a^2\,b + a\,b^2$
$\quad a^2\,b + 2\,a\,b^2 + b^3$

$a^3 + 3\,a^2\,b + 3\,a\,b^2 + b^3$, ka papa 3.
$a + b$

$a^4 + 3\,a^3\,b + 3\,a^2\,b^2 + a\,b^3$,
$\quad a^3\,b + 3\,a^2\,b^2 + 3\,a\,b^3 + b^4$

$a^4 + 4\ a^3\ b + 6\ a^2\ b^2 + 4\ a\ b^3 + b^4$, ka papa 4.
$a + b$

$a^5 + 4\ a^4\ b + 6\ a^3\ b^2 + 4\ a^2\ b^3 + a\ b^4$
$\quad a^4\ b + 4\ a^3\ b^2 + 6\ a^2\ b^3 + 4\ a\ b^4 + b^5$

$a^5 + 5\ a^4\ b + 10\ a^3\ b^2 + 10\ a^2\ b^3 + 5\ a\ b^4 + b^5$, papa 5.

E loaa na papa o na mea hui ma ka hoonui. Ua hoailonaia no hoi keia mau papa e ka hoike: Penei, $(a + b + e)^3$, ua hoailona mai ka hoike ma ka akau o ke apowaena i ka papa 3 o $a + b + e$.

2. E hoonui i ka hua kaulua mea koena, i $a - b$ a hiki i ka papa 5.

$a - b$, papa 1.
$a - b$

$a^2 - a\ b$
$\quad - a\ b + b^2$

$a^2 - 2\ a\ b + b^2$, ka papa 2.
$a - b$

$a^3 - 2\ a^2\ b + a\ b^2$
$\quad - a^2\ b + 2\ a\ b^2 - b^3$

$a^3 - 3\ a^2\ b + 3\ a\ b^2 - b^3$, ka papa 3.
$a - b$

$a^4 - 3\ a^3\ b + 3\ a^2\ b^2 - a\ b^3$
$\quad - a^3\ b + 3\ a^2\ b^2 - 3\ a\ b^3 + b^4$

$a^4 - 4\ a^3\ b + 6\ a^2\ b^2 - 4\ a\ b^3 + b^4$, ka papa 4.
$a - b$

$a^5 - 4\ a^4\ b + 6\ a^3\ b^2 - 4\ a^2\ b^3 + a\ b^4$
$\quad - a^4\ b + 4\ a^3\ b^2 - 6\ a^2\ b^3 + 4\ a\ b^4 - b^5$

$a^5 - 5\ a^4\ b + 10\ a^3\ b^2 - 10\ a^2\ b^3 + 5\ a\ b^4 - b^5$, papa 5.

3. Heaha ka papa 2 o $3\ a - b + 2\ e$?
$3\ a - b + 2\ e$
$3\ a - b + 2\ e$

$$
\begin{array}{r}
9\,a_2 - 3\,a\,b + 6\,a\,e \\
-3\,a\,b + b^2 - 2\,b\,e \\
\qquad\qquad 6\,a\,e - 2\,b\,e + 4\,e^2 \\
\hline
9\,a^2 - 6\,a\,b + 12\,a\,e + b^2 - 4\,b\,e + 4\,e^2
\end{array}
$$

4. Heaha ka papa 3 o ka $a + 1$?
5. E hookiekie ae i ka $m + n + w$ ma ka papa 2.
6. E hoonui ae i ka $a + b + e + o$ a hiki i ka papa 2.
7. Heaha ka papa 3 o ka $2\,a - w + e^2$?
8. Heaha ka papa 3 o ke $3\,a + 2\,b$?
9. Heaha ka papa 2 o ka $a + b - e$?
10. Heaha ka papa 3 o ka $a - w + 8$?
11. Heaha ka papa 2 o ka $\frac{a}{b}$? Eia, $\frac{a^2}{b^2}$.

No ka mea, $\frac{a}{b} \times \frac{a}{b} = \frac{a\,a}{b\,b}$ oia hoi $\frac{a^2}{b^2}$. Nolaila, *Ke hookiekie nei kakou i ka hakina, ma ka hoonui ana i ka hoohelu a me ka mahele, a hiki i ka papa i makemakeia.*

12. Heaha ka papa 2 o ka $\frac{a^2\,b}{m^2\,w}$? Eia, $\frac{a^4\,b^2}{m^4\,w^2}$.
13. Heaha ka papa 2 o ke $\frac{3\,a^2\,b^2}{m\,w^2}$?
14. Heaha ka papa 2 o ka $\frac{4\,a^3\,b^2\,w}{3\,p^2\,m}$?
15. Heaha ka papa 2 o ka $\frac{a+b}{m-w}$?
16. Heaha ka papa 3 o ka $\frac{a-5}{w}$?
17. Heaha ka papa 3 o ke $\frac{3\,m^2\,w}{2\,a^2}$?
18. Heaha ka papa 2 o ka $\frac{2\,a-3}{b^2-e}$?
19. Heaha ka papa 4 o ka $\frac{4}{2\,m^2\,w}$?
20. Heaha ka papa 2 o ka $\frac{5\,w^2-a^3}{9}$?
21. Heaha ka papa 2 o ka $\frac{m-w}{a^2\,b}$?

PAUKU III.

Ka mea kaulua Hoike.

No ka loihi o kela hana ana e loaa'i na papa kiekie, ma ka hoonui wale ana no, ua hoikeia mai malalo iho nei o ke *Kumu hana* e loaa koke ai ka papa i makemakeia.

Ina makemake kakou e kakau i kekahi papa o na hua kaulua, eha mau mea e pono ke malamaia; 1 *ka helu o na hua o ia papa;* 2, *na kaha* + *a me* —; 3, *na hoailona papa;* 4, *na heluna.*

Na hua. *O na hua iloko o kekahi papa, ua oi aku ma ka helu ana i hookahi mamua o ka hoailona o ia papa.* Pela no, e 3 mau hua o ka papa 2, e 4 mau hua o ka papa 3, e 5 mau hua o ka papa 4, a pela aku no.

Na kaha. Ma na papa o na hua kaulua o $a + b$, a o $a - b$, ua like na hoailona papa, o na kaha wale no ka like ole. *He mau mea io na mea a pau o ka mea kaulua hui; aka, o na hua o ke kaulua emi, he mea io ole ka lua, ka ha, ke ono, a pela aku, a he mea io no ka mua, ke kolu, ka lima, ka hiku, a pela aku no.*

Na Hoailona papa. O ka hua mua o kela papa keia papa, oia ka hua mua o ka mea kaulua i kakau mua ia; o ka *a* i hookiekieia'e a hiki i ua papa la. A o na hoailona e ae o ua hua la, ua emi pakahi no lakou ma ka akau aku. Ua kapaia ka hua mua, o *a*, ka *hua alakai*, a o kona mau hoailona no ka papa 7, eia no penei,

7, 6, 5, 4, 3, 2, 1.

O ka hua hope o kela papa keia papa, oia ka hua hope o ka mea kaulua, o *b*, i hookiekieia'e i ua papa la. A o na hoailona e ae o ua hua la, ua emi pakahi no lakou ma ka hema aku. O ka hua hope o ke kaulua, o *b*, ua kapaia, o ka *mea hahai;* a o kona mau hoailona no ka papa 7, eia no penei,

1, 2, 3, 4, 5, 6, 7.

O ka huina o na hoailona papa, o ia mau`hua elua, (o a laua o b) ua like ia me ka hoailona o ka papa kahi a laua e ku ana. Ma ka papa 7, $a^6\,b^1 = 7$, $a^5\,b^2 = 7$ a pela aku.

E hoopili kakou ano ia mau olelo hoakaka; o na hua kaulua ma ka papa 7, ewalu ia mau hua, oia hoi, ua oi pakahi aku no lakou mamua o ka hoailona o ia papa. Penei e ku ai ko lakou mau hoailona, e waiho ana i na heluna;

$$(a+b)^7 = a^7 + a^6\,b + a^5\,b^2 + a^4\,b^3 + a^3\,b^4 + a^2\,b^5 + a\,b^6 + b^7$$
$$(a-b)^7 = a^7 - a^6\,b + a^5\,b^2 - a^4\,b^3 + a^3\,b^4 - a^2\,b^5 + a\,b^6 - b^7$$

NA HELUNA. I ka nana ana i na hua maluna iho, *Ua akaka ka heluna o ka hua mua he* 1, *a o ka heluna o ka* 2 *o ka hua, ua like ia me ka hoailona o ka papa.* A e ikeia auanei na heluna e koe ma keia KUMU HANA: *Ina e hoonuiia ka heluna o kekahi hua me ka hoailona papa o ka hua alakai o ua hua la, a e puunaueia ka huina i ka nui o na hua mai ka hema ae, mai ke kahi o ka hua a i ka lua, oia* 2 *ke puunaue, a pela aku ke* 3, *a ka ha, e loaa auanei ka heluna no kela hua aku e pili ana ma ka akau.*

O na heluna o $a+b$ i hookiekieia'e i ka papa 7, penei;

$$1,\ 7,\ \frac{7\times 6}{2},\ \frac{21\times 5}{3},\ \frac{35\times 4}{4},\ \frac{35\times 3}{5},\ \frac{21\times 2}{6},\ \frac{7\times 1}{7}.$$

$$1,\ 7,\ 21,\ 35,\ 35,\ 21,\ 7,\ 1.$$

Ina e kauia kela mau heluna imua o na hua $a+b$, a o $a-b$ i loaa maluna, ua pau ka hana e loaa'i ka papa 7; penei,

$$(a+b)^7 = a^7 + 7\,a^6\,b + 21\,a^5\,b^2 + 35\,a^4\,b^3 + 35\,a^3\,b^4 + 21\,a^2\,b^5 + 7\,a\,b^6 + b^7.$$
$$(a-b)^7 = a^7 - 7\,a^6\,b + 21\,a^5\,b^2 - 35\,a^4\,b^3 + 35\,a^3\,b^4 - 21\,a^2\,b^5 + 7\,a\,b^6 - b^7.$$

Ua like na heluna o ka hua mua a me ka hua hope, ua like hoi ka heluna o ka hua lua me ko ka hua e pili ana me ka hope, a pela aku no. Nolaila, ina ua loaa na heluna mua e like ana me na heluna i koe mahope, e hiki ilaila ke kakau wale iho i na heluna koe.

3. Heaha ka papa 4 o $m + w$?

Eia, $m^4 + 4\,m^3\,w + 6\,m^2\,w^2 + 4\,m\,w^3 + w^4$.

4. Heaha ka papa 6 o $m - w$?
5. Heaha ka papa 5 o $a + e$?
6. Heaha ka papa 8 o $m - n$?
7. Heaha ka papa 4 o $m + n$?
8. Heaha ka papa 7 o $m + w$?
9. Heaha ka papa 9 o $a + b$?
10. Heaha ka papa 10 o $e + l$?
11. Heaha ka papa 13 o $a - b$?
12. Heaha ka papa 6 o $l + p$?
13. Heaha ka papa 7 o $e - i$?
14. Heaha ka papa 3 o $a + 3\,b\,e$?

O keia mea, aole ia e hiki ke hanaia ma keia ano, aia ma ka hoonui maoli wale no: no ka mea, ma na kumu hana mamua, e hiki wale no ke pakahiia kela hua keia hua o ka mea kaulua, he 1 hoi ka heluna. E pono ke hoailona i ke $3\,b\,e$ ma kekahi hua hookahi, alaila e hana aku penei:

E kakau i m ma kona wahi e like ai ia me ke $3\,b\,e$. Nolaila, ua loaa ka mea kaulua $a + m$, a o ka papa 3 o ia mea,

$$a^3 + 3\,a^2\,m + 3\,a\,m^2 + m^3.$$

Ma kahi o ka m, e kau iho i kona kumu, alaila, ua loaa ka papa i makemakeia. Ua manao kakou o ka $m = 3\,b\,e$; nolaila, $m^2 = 9\,b^2\,e^2$, o ka $m^3 = 27\,b^3\,e^3$.

O ka mea kau mua, he a^3.

Ka 2 o ka mea kau, he $3\,a^2\,m$, oia $3\,a^2 \times 3\,b\,e = 9\,a^2\,b\,e$.

O ke kolu, he $3\,a\,m^2$, oia $3\,a \times 9\,b^2\,e^2 = 27\,a\,b^2\,e^2$.

O ka ha, he $m^3 = 27\,b^3\,e^3$.

Eia a pau, $a^3 + 9\,a^2\,b\,e + 27\,a\,b^2\,e^2 + 27\,b^3\,e^3$.

15. Heaha ka papa 4 o $2\,a\,b - w$?

E hoolike i m me $2\,a\,b$, alaila, e hookiekie i ka $m - w$, penei,

$$m^4 - 4\,m^3\,w + 6\,m^2\,w^2 - 4\,m\,w^3 + w^4.$$

Ma kahi o ka m e kakau iho i kona kumu, o ka $m = 2$

$a\,b$, alaila $m^2 = 4\,a^2\,b^2$, $m^3 = 8\,a^3\,b^3$, a o ka $m^4 = 16\,a^4\,b^4$.

Eia a pau, $16\,a^4\,b^4 - 32\,a^3\,b^3 + 24\,a^2\,b^2\,w^2 - 8\,a\,b\,w^3 + w^4$.

16. Heaha ka papa 2 o $4\,a\,b + 5\,e^2$?

Ina o ka $m = 4\,a\,b$, a o ka $n = 5\,e^2$; alaila e hookiekie i ka $m + n$: o ka papa 2 o $m + n$, he $m^2 + 2\,m\,n + n^2$.

E kakau iho i na kumu o ka $m + n$ ma ko laua mau wahi, penei, $m = 4\,a\,b$, a o ka $m^2 = 16\,a^2\,b^2$; a o ka $n = 5\,e^2$, a o ka $n^2 = 25\,e^4$.

Eia a pau $16\,a^2\,b^2 + 40\,a\,b\,e^2 + 25\,e^4$.

17. Heaha ka papa 3 o $n + p + w$?

E hoolike i ka m me ka $p + w$, a e hana ma ka $n + m$, oia ka mea like me ka $n + p + w$. O ka papa 3 o $n + m$; eia, $n^3 + 3\,n^2\,m + 3\,n\,m^2 + m^3$.

E hoihoi i ke kumu o ka m.

$$m = p + w$$
$$m^2 = p^2 + 2\,p\,w + w^2$$
$$m^3 = p^3 + 3\,p^2\,w + 3\,p\,w^2 + w^3.$$

Eia a pau, $n^3 + 3\,n^2\,p + 3\,n^2\,w + 3\,n^2\,p^2 + 6\,n\,p\,w + 3\,n\,w^2 + p^3 + 3\,p^2\,w + 3\,p\,w^2 + w^3$.

18. Heaha ka papa 2 o $a + b + e + h$?

O ka $m = a + b$, a o ka $n = e + h$, a e hoonui i ka $m + n$.

$$(m + n)^2 = m^2 + 2\,m\,n + n^2.$$

Alaila, e hoihoi mai i na kumu o $m + n$, penei,

$$m^2 = a^2 + 2\,a\,b + b^2.$$
$$n^2 = e^2 + 2\,e\,h + h^2.$$

Eia a pau, $a^2 + 2\,a\,b + b^2 + 2\,a\,e + 2\,b\,e + 2\,a\,h + 2\,b\,h + e^2 + 2\,e\,h + h^2$.

Pela no e hookiekieia'e kela mea keia mea a pau i ka papa i makemakeia ma keia kumu hana: *E hoolilo mua ia ka haawina i na hua pakahi elua; a pau ka hoonui ana alaila, e hoihoiia ke kumu o ia mau hua pakahi.*

19. Heaha ka papa 2 o ka $a - 3\,b$?

20. Heaha ka papa 3 o ka $5\,a^2 + b$?

21. Heaha ka papa 2 o 3 $a^2 + 5\ b^3$?
22. Heaha ka papa 2 o ka $a + b^2 - 7$?
23. Heaha ka papa 3 o ka $2w - i + k2$?
24. Heaha ka papa 5 o ka $a^2 - e - 2\ h$?
25. Heaha ka papa 5 o ka $7\ m^2\ n^5 - 10\ m^5\ w2$?

PAUKU IV.

Houluulu.

1. Heaha ka huina o ka a^2 a me b^2? Eia, $a_2 + b_2$?

No ka mea, ua like ole na hua, a e hiki ke hookui ia mau mea ma ke kaha + wale no.

2. Heaha ka huina o ka a^2 me ka a^3? Eia, $a^2 + a^3$?

O na papa okoa o ka hua hookahi, ua maopopo he mau mea okoa ia, a e hookui like ia laua me kela maluna. Ina o ka $a = 4$, $a^2 = 4 \times 4 = 16$; a o ka $a_3 = 4 \times 4 \times 4 = 64$: a o ka $a^2 + a^3 = 16 + 64 = 80$. Aka, $2\ a^2 = 16 \times 2 = 32$; a o ka $2\ a^3 = 64 \times 2 = 128$. Nolaila, aole ka $2\ a^2$, aole hoi ka $2\ a^3$ ka huina pono o a^2 me a^3.

3. Heaha ka huina o ka $2\ a^2$ me ke $3\ a^2$? Eia, $5\ a^2$.

No ka mea, $2\ a^2 = 2 \times a^2$; a $3\ a^2 = 3 \times a^2$; a $(2+3) \times a^2 = 5\ a^2$. Ina o ka $a = 4$; alaila, $2\ a^2 = 2 \times 4 \times 4 = 32$; a $3\ a^2 = 3 \times 4 \times 4 = 48$; a he $32 + 48 = 80$. Aka, $5\ a^2 = 5 \times 4 \times 4 = 80$ no hoi.

E nana, aole i hoololiia na hoailona papa i ka houluulu ana i na papa.

Nolaila ua akaka, O na hua like ma na papa like, he mau mea like no ia, a ua hookui maoli ia; aka, o na hua okoa, a o na hua like ma na papa okoa, he mau mea like ole no ia, a e pono ke hookuiia ma ke kaha +.

4. Heaha ka huina o ka a^3 me ka b^3? Eia, $a^3 + b^3$.
5. Heaha ka huina o ka a^3 me ka a^4?
6. E houluulu i $2\ a^2$, $3\ a^2$, $4\ a^2$, me $5\ a^2$.

7. Heaha ka huina o 2 a^3, w^2, 3 a^3 me 5 w^2?

8. Heaha ka huina o $a\,w^2$, $b\,w^2$, $e\,w^2$, me $h\,w^2$?

9.)
$$\begin{array}{r} 5\,a^3 b + 3\,a^2 b e - 7\,a b^3. \\ -8\,a^3 b - 8\,a^2 b e + 7\,a b^3. \\ \hline 9\,a^3 b + 5\,a^2 b e - a b^3. \end{array}$$

10.)
$$\begin{array}{r} a^3 w^2 + b i^2. \\ e h w^2 + h i^2. \\ \hline -2\,a^3 w^2 - h i^2. \end{array}$$

11. Heaha ka huina o $a\,(m^2 - n^3)^2$, 3 $a\,(m^2 - n^3)^2$, me 5 $a\,(m^2 - n^3)^2$?

12. Heaha ka huina o 8 $(a^2 - b^3)^2$ me 4 $(a^2 - b^3)^3$?

13. E houluulu i 5 $a^2 b\,e^3$, 3 $a^2\,b\,e^3$, $a^2\,b\,e^3$, me 2 $a^2\,b^3\,e$.

14. Heaha ka huina o 3 $a^3 + b\,e^2$, 5 $a^3 + 2\,b\,e^2$, $a^3 + 5\,b\,e^2$, 6 $a^3 + 2\,b\,e^2$?

15. Heaha ka huina o $\frac{1}{2}\,(a^2 - b\,w)^3$, $\frac{3}{4}\,(a^2 - b\,w)^3$, 3 $(a^2 - b\,w)^3$ me $\frac{1}{4}\,(a^2 - b\,w)^3$?

16. E houluulu i $a^2\,b^3 + 7 + m^2$, 3 $a^2\,b^3 + 9$, $m^2 + 14$, 3 $a^2\,b^3 - 19 - 5\,m^2$, $12 - 2\,a^2\,b^3$, me 4 $a^2\,b^3 - 8 + 2\,m^2$.

17. E houluulu i $a^3\,(b^2 - 12\,a^3 + i^4)^3$, 3 $a^3\,(b^2 - 12\,a^3 + i^4)^3$, 2 $a^3\,(b^2 - 12\,a^3 + i^4)^3$, me 8 $a^3\,(b^2 - 12\,a^3 + i^4)^3$.

18. Heaha ka huina o $m^2\,n^3 + 14 - 13\,b^2$, me $12 + 3\,m^2\,n^3 - 8\,b^2$, me $15\,b^2 - 20 - m^2\,n^3$?

PAUKU V.

Ka Unuhi.

1. E unuhi i ka b^2 mailoko ae o ka a^3. Koe $a^3 - b^2$.

Ua hanaia na haawina o ka unuhi e like me ko ka houluulu; aka, ua hoololiia na kaha o na mea unuhi.

E ike hoi, aole e loli na hoailona papa ma ka unuhi, e like me ko lakou loli ole ia ma ka houluulu.

2. E unuhi 2 a^3 mailoko ae o 5 a^3. Koe 3 a^3.

3. E lawe i 3 $(a^2 - b^3)$, mailoko ae o 5 $(a^2 - b^3)$.

4. E lawe i $5\,a^2\,(a^3 - b^2 + 3)^2$ mailoko o $6\,a^2\,(a^3 - b^2 + 3)^2$.

5. E lawe i $3\,a^5\,b^3$ mailoko mai o $7\,a^5\,b^3$.

6. E lawe i $2\,a^2$ mailoko ae o $3\,a^3$.

7. E unuhi i $3\,a^3$ mailoko o $5\,a^3$.

8. E unuhi i $5\,a^2\,b$ mailoko o $2\,a^3\,m$.

9. E unuhi i $7\,a^2\,w$ mailoko o $9\,a^2\,w$.

10. E unuhi i $5\,a^2\,w + 3\,h^2\,w$ mailoko o $8\,a^2\,w - 4\,h^2\,w$.

11. Noloko o $8\,a^2\,m\,n - m^3$ e lawe i $5\,a^2\,m\,n + 2\,m^3$.

12. Nol. o $9a^2m^3 - 13 + 20a^2bm^3$
E law. i $3a^2m^3 + 16 - 12a^2bm^3$.

13.) $17a^2m^3 + 5mn^2$
$12a^2m^3 - 4mn^2$.

14. Nol. o $5(a^2 - b^3)^2 + m^2n$
E law. i $3(a^2 - b^3)^2 + 2m^2n$.

15.) $2m(a - b)^3 + (a - b)^3$
$m(a - b)^3 + (a - b)^3$.

16. Noloko o $3\,a^3\,(b^2 - 8)^3$, e lawe i $a^3\,(b^2 - 8)^3$.

17. Noloko o $5\,m^2\,(b^2 - e^3)$, e lawe i $2\,m^2\,(b^2 - e^3)$.

18. E lawe i $3\,a^2\,b - 3\,m^2\,n^3 + 8$ noloko o $8\,a^2\,b + m^2\,n^3 - 17$.

19. Noloko o $5\,m^3\,n\,(a\,b^2 - 17)^3$, e lawe i $3\,m^3\,n\,(a\,b^2 - 17)^3$.

20. E unuhi i $6\,a\,b^2\,e^3 - b^2\,e^3 + 7\,a$ mailoko o $8\,a\,b^2\,e^3 + 2\,b^2\,e^3 - 3\,a^2$.

PAUKU VI.

Ka Hoonui.

1. Heaha ka huina o $4\,a^2$ i hoonuiia me $5\,a^3$?

Eia, $20\,a^5$.

Penei kahi e pono ke kakau i ka huina, $20\,a^2\,a^5$; oia $20\,a\,a\,a\,a\,a$, oia hoi $20\,a^5$. Aka, he 5 ka huina o na hoailona papa, nolaila, e hiki wawe ka huina ma ka hookui ana i na hoailona papa o na hua. Penei, $a^2 \times a^3 = a^{2+3}$, oia

a^5. Pela hoi $m^4 \times m^5 = m^{4+5}$, oia m^9; a o ka $a^2 b^3 \times a^3 b^4 = a^{2+3} b^{3+4}$, oia $a^5 b^7$.

Nolaila, ina e kau ana ka hua hookahi o kela papa keia papa, ma ke kumu hoonui kekahi a ma ka mea hoonui kekahi, *e hookui i na hoailona papa o laua, a o ka huina ka hoailona papa o ka huina kumu.*

2. E hoonui i $3\ a^2\ b$ me $6\ a\ b^3$. Eia, $18\ a^3\ b^4$.
3. E hoonui i $8\ a^3\ b^2\ m$ me $2\ a^2\ b^2\ m$.
4. E hoonui i $3\ a^5\ b^2\ m\ n$ me $5\ a\ b^3\ m^3\ n^5$.
5. E hoonui i $9\ a^3\ e^2\ m$ me $9\ a^3\ e^2\ m$.
6. E hoonui i $m^3 + 5\ a$ me m^2.
7. E hoonui i $3\ a^2 - 5\ a\ m^3$ me $2\ a^3\ m^2$.
8. E hoonui i $a\ i - 6 + i^3$ me $a^3\ i^2$.
9. E hoonui i $a^3 - b^2$ me $a^3 + b^2$.
10. E hoonui i $a^2\ b\ e^3 - 12$ me $2\ a^2\ b^3$.
11. E hoonui i $m^3 + m^2\ n + m\ n^2 + n^3$ me $m - n$.
12. E hoonui i $a^3 + a - 6$ me $2\ a^2 + a + 1$.
13. E hoonui i $a^2 + a^4 + a^6$ me $a^2 - 1$.
14. E hoonui i $3\ (m^2 - n^3)^2$ me $a\ (m^2 - n^3)^2$. Eia, $3\ a\ (m^2 - n^3)^4$.
15. E hoonui i $a^2\ (m^3 - 12 + m^2)^3$ me $a\ b\ (m^3 - 12 + m^2)^3$.
16. E hoonui i $3\ (a^2 + b^3)^2$ me $5\ (a^2 + b^3)^2$.
17. E hoonui i $a\ (m^3 - n^2 + 4)^3$ me $6\ (m^3 - n^2 + 4)^3$.
18. E hoonui i $3\ a^2\ (m^3 - n^3)^2$ me $4\ a^2\ (m^3 - n^3)^2$.
19. E hoonui i $4\ a^2 - 16\ a\ m + 3\ m^2$ me $5\ a^3 - 2\ a^2\ m$.
20. E hoonui i $a^4 - 2\ a^3\ b + 4\ a^2\ b^2 - 8\ a\ b^3 + 16\ b^4$ me $a + 2\ b$.
21. E hoonui i $2 + 6\ a^2 - b^3$ me $m^2 - a$.
22. E hoonui i $\frac{m^3 - n^2}{a^2 + b}$ me $\frac{m^3 + n^2}{a^2 - 8}$.

PAUKU VII.

Ka Puunaue.

1. E puunaue i a^5 i ka a^3. Eia, a^2.

Ina e hookuiia ka hoailona papa o ka mahele me ko ka puuhapa, e like no ka huina me ka hoailona papa o ka puuokoa. No ka mea, ua hoonui pu ia ua mau mea la elua ma ka hookui ana i ko laua mau hoailona papa; a e mau ana ka like o ka huina o ka mahele laua o ka puuhapa i hoonui pu ia me ka puuokoa.

Ma ia haawina maluna, o ka puuokoa, $a^5 = a\,a\,a\,a\,a$, a o ka mahele, $a^3 = a\,a\,a$; a e hiki ke kakau i ka puunaue, penei; $\frac{a\,a\,a\,a\,a}{a\,a\,a}$. Ina e hoonalo i na $a\,a\,a$ ma ka hoohelu a me ka mahele, e koe no $a\,a$ no ka puuhapa, oia hoi a^2 e like ana me ia maluna.

Nolaila, ina e puunaue kakou i ka papa o kekahi hua, me kekahi papa okoa o ia hua, me a^5 paha me ka a^3. *E unuhi kakou i ka hoailona papa o ka mahele mailoko ae o ka hoailona papa o ka puuokoa, a o ke koena o ka hoailona papa o ka puuhapa.*

2. E puunaue i a^6 i ka a^3.
3. E puunaue i $a^3\,b^4$ i ka $a\,b^3$.
4. E puunaue i $a^6\,b^5\,e^2$ i ka $a^6\,b^4\,e$.
5. E puunaue i $16\,a^{10}\,b^4\,m^2$ i ka $4\,a^5\,b^3\,m^2$.
6. E puunaue i $39\,a^2\,m^3\,n^4$ i ka $13\,a^2\,m^2\,n^3$.
7. E puunaue i a^2 i ka a^2. Eia, 1.

Ma ke kumu hana maluna, o ka $a^2 \div a^2 = a^0$; no ka mea, $a^2 - a^2 = a^0$. Aka, $\frac{a^2}{a^2} = 1$; no ka mea, ina e puunaueia kekahi mea i kona mea like, o ke 1 ka puuhapa. Nolaila, *ua maopopo ka like o ka* a^0 *me ke* 1. A pela no na hua e ae a pau, ina he ^{0} kona hoailona papa.

8. E puunaue i a^5 i ka a^5.
9. E puunaue i $5\,a^3$ i ka $5\,a_3$.

10. E puunaue i a^2 i ka a^3. Eia, a^{-1}.

Ma keia, ua oi aku ka hoailona papa o ka mahele maluna o ko ka puuokoa; aka, pono ke hana mamuli o ke kumu hana. Penei, $a^2 \div a^3 = a^{2-3} = a^{-1}$. Ma ka hua a^{-1}, he *hoailona emi* ko ka a. Pela hoi ka $a \div a^2 = a^{-1}$; $a \div a^3 = a^{-2}$; $a \div a^4 = a^{-3}$; a pela aku.

11. E puunaue i a^7 i ka a^9. Eia, a^{-2}.

12. E puunaue i $a^2\ b^4\ m^3$ i ka $a^5\ b^6\ m^7$.

13. E puunaue i a^0 i ka a. Eia, a^{-1}.

Penei e hoakakaia'i ka puunaue ana; $a^0 + a^1 = a^{-1}$. Aka, o ka $a^0 = 1$; nolaila, $\frac{a^0}{a} = \frac{1}{a}$; nolaila hoi, $a^{-1} = \frac{1}{a}$.

Ma ia hana ana e ikeia auanei ke kumu o na papa mea hoailona emi. Penei, $a^0 = 1$; $a^{-1} = \frac{1}{a}$; $a^{-2} = \frac{1}{a^2}$; $a^{-3} = \frac{1}{a^3}$; $a^{-4} = \frac{1}{a^4}$, a pela aku.

Ina o ke kumu o ka a he 2 ia, alaila, o ka $a^0 = 1$; $a^{-1} = \frac{1}{2}$; $a^{-2} = \frac{1}{4}$; $a^{-3} = \frac{1}{8}$; $a^{-4} = \frac{1}{16}$; $a^{-5} = \frac{1}{32}$; a pela aku.

14. E puunaue i $(a + b)^3$ i ka $(a + b)^3$.

15. E puunaue i $(a^2 - m^3 + b)^4$ i ka $(a^2 - m^3 + b)^2$.

16. E puunaue i $(a^3 + 5 - m)^3$ i ka $(a^3 + 5 - m)^7$.

17. E puunaue i $a\ b^3 + 2\ a^3\ b + 2\ a^2\ b^2 + a^4$ i ka $a\ b^2 + a^3 + a^2\ b$.

Mamua o ka puunaue ana i na mea hui, e hoonohonoho pono kakou i na hua o ka mahele a me ka puuokoa, i hiki wawe ka hana ana. Pono e kau mua i ka mea papa kiekie, a e hoopili mai i ka papa haahaa iho mahope, a pela aku no. O ka hua mua o ka mahele, a o ka hua mua o ka puuokoa, i hookahi no ia mau hua.

No ka hoonohonoho pono ana, ke kau nei kakou i ka hua mea papa kiekie ma ka mua, a me na hua e ae mahope iho e like me ko lakou nui ana, penei; $a^3 + a^2\ b + a\ b^2$. No ka mea, he a ka hua mua o ka mahele, pela no he a ka pono no ka hua mua o ka puuokoa, a penei ka hoonohonoho ana; $a^4 + 2\ a^3\ b + 2\ a^2\ b^2 + a\ b^3$.

$$a^3 + a^2\,b + a\,b^2 \;)\; a^4 + 2\,a^3\,b + 2\,a^2\,b^2 + a\,b^3 \;(\; a + b.$$

$$\underline{a^4 + a^3\,b + a^2\,b^2}$$

$$a^3\,b + a^2\,b^2 + a\,b^3$$

$$\underline{a^3\,b + a^2\,b^2 + a\,b^3}$$

$$* \qquad * \qquad *$$

18. E puunaue i $a\,b^3 - b^3\,e$, i ka $a - e$.

19. E puunaue i $3\,a^5 + 16\,a^4\,b - 33\,a^3\,b^2 + 14\,a^2\,b^3$ i ka $a^2 + 7\,a\,b$.

20. E puunaue i $w^3 + 9\,w^2 + 4\,w - 80$, i ka $w + 5$.

21. E puunaue i $b^8 - 16\,e^8$ i ka $b^2 - 2\,e^2$.

22. E puunaue i $a^2\,m - b^2\,m + 8\,m - a^2\,n^3 + b^2\,n^3 - 8\,n^3$, i ka $m - n^3$.

23. E puunaue i $a^6 - a^4\,w - a^2\,w^3 + 2\,w^4$ i ka $a^4 - w^3$.

MOKUNA VIII.

KA HOOHALIKE ANA O NA HUA PAPA MUA.

PAUKU I.

Na mea hoakaka.

Aia hanaia a like na mea okoa elua, a kaulike ia laua me ke kaha = mawaena o laua, ua kapaia keia hana ana, *He Hoohalike.* O keia, $8 + 4 = 18 - 6$, he hoohalike ia; ua like na huina o kela mea keia mea, a he okoa hoi na huahelu i hookuiia. Pela hoi, ina e hoailona ana ka $w + 5$, a o ka $a - 7$ i na kumu like, alaila, e pono ke kakau i ka hoohalike, $w + 5 = a - 7$.

Ma ka hoohalike ana ka nui o na hana ma ka Hoailona Helu; a o na mokuna mua o keia buke, he mau mea hoomakaukau wale no, e pono ai keia hana ana.

Iloko o ka hoohalike o ka papa mua, ua imiia ka mea ikea ole ma ka papa mua, e like me ka w. *Ina ma ka papalua, a ke kolu paha ka mea ikea ole, alaila, ua kapaia ka hana ana, He hoohalike o ka papalua, a o ka papa kolu paha.*

O na hua e kau ana ma ka hema o ke kaha =, ua kapaia ka aoao mua o ka hoohalike; a o na hua ma ka akau, ka aoao hope. Ma ka hoohalike, $w + 6 = a - 5$, o ka $w + 6$ ka aoao mua, a o ka $a - 5$ ka aoao hope.

E hiki pono ke hoololi kekahi aoao o ka hoohalike, ke loli like ia kela aoao, i malamaia'i ko laua like ana, penei;

Ma ka hoohalike $8 + 4 = 18 - 6$.

E hui i ka 10 i kela aoao i keia aoao:

$8 + 4 + 10 = 18 - 6 + 10$.

E unuhi i 12 mai na aoao a elua:

$8 + 4 + 10 - 12 = 18 - 6 + 10 - 12$.

E hoonui i na aoao a elua i ka 2:

$16 + 8 + 20 - 24 = 36 - 12 + 20 - 24$.

E puunaue i na aoao a elua i ka 4:

$4 + 2 + 5 - 6 = 9 - 3 + 5 - 6$.

Ma ia mau hana ua ikea ka hoololiia ana o ka hoohalike $8 + 4 = 18 - 6$, aka, ua malamaia ka like ana o na aoao o ka hoohalike ma na loli ana a pau. Nolaila, ua akaka,

1. *E hiki ke hui aku i ka huina hookahi ma na aoao a elua o ka hoohalike;*

2. *E hiki ke unuhi iho i ka mea hookahi mai na aoao a elua o ka hoohalike;*

3. *E hiki ke hoonui i na hua a pau o ka hoohalike me ka mea hookahi; a*

4. *E hiki hoi ke puunaue i na hua a pau o ka hoohalike i ka mea hookahi; aole hoi e hoololiia ka like ana o na aoao, ma kekahi o ia mau hana.*

Aia ninauia mai kekahi mea, i mea e hanaia'i ma ka Hoailona Helu, eia ka mea mua e hanaia'i, *o ke kakau i na hua ma ka hoohalike.*

A paa ka hoohalike i ke kakauia, e imi i ke kumu o ka mea i ike ole ia, ma na hua o ka hoohalike, a o keia hana ana, ua kapaia *ka hoomaopopo ana i ka hoohalike.*

Aohe nui na kumu hana no ka hoomaopopo ana i ka hoohalike, aole hoi he pohihihi. Eia kekahi mau mea e manao ai, i hiki pono ka hoolilo ana o ka haawina i hoohalike.

A heluhelu oe i kekahi haawina, e noonoo pono oe a ike i ke ano o ka haawina.

E hoailona i ka mea i ninauia, oia hoi ka mea i ike ole ia,

e kekahi huaolelo hope o ka papa A, he m paha, he w paha.

E manao i ua hoailona la, ke kumu ia o ka hana ana, a e hana me ia mea, e like me ka hana ana i ke kumu io, i ka hoomoakaka ana i kona oiaio.

O ka mea i loaa malaila, oia kekahi aoao o ka hoohalike, a e loaa like me ia kona kumu ma kela aoao o ka hoohalike.

Eia kekahi hana e hoomoakaka i keia olelo kuhikuhi: Ua haawi kekahi kanaka i na dala he 175 no kona wati, me ke kaula, a me ke ki. O ke kumukuai o ke ki, he hapalua ia o ke kumu i make ai ke kaula; a o ke kumukuai i ke kaula, he hapalua ia o ke kumu i make ai ka wati. Heaha ke kumu e kuai ai i kela mea keia mea?

Maanei, ekolu mau mea i ike ole ia, oia na kumukuai o ka wati, ke kaula, a me ke ki; a e hiki ke hoailona i kekahi o keia mau mea ma ka w, a ikea ke kumukuai o ia mea, malaila e loaa no hoi ka ike i na mea elua i koe.

Eia mua, e manao kakou he w na dala i make ai ka wati; nolaila, ua make ke kaula i $\frac{w}{2}$ o na dala, oia ka hapalua o na dala i make ai ka wati; a o na dala o ke ki, he $\frac{w}{4}$ ia, oia ka hapalua o ke kumukuai o ke kaula: a ua make ia mau mea ekolu, he $w + \frac{w}{2} + \frac{w}{4}$ na dala. Aka, o na dala no ia mau mea a pau, he 175 ia, nolaila, ua loaa ka hoohalike,

$$w + \frac{w}{2} + \frac{w}{4} = 175.$$

Eia hou, e hoailona kakou i ke kaula i na w dala; a ua palua na dala o ka wati i ko ke kaula, oia $2\,w$ na dala; a o ke ki he hapalua ia o ke kaula, oia he $\frac{w}{2}$, a o ia mau mea ekolu, he $2\,w + w + \frac{w}{2}$ na dala; a eia ka hoohalike,

$$2\,w + w + \frac{w}{2} = 175.$$

Eia hou, e hoailonaia ke ki e ka w: alaila, o ke kaula,

ua palua na dala ia i ko ke ki, he $2w$ ia; a o ka wati, he palua na dala ia i ko ke kaula, a he $4w$ hoi ia, a o na dala a pau, $4w + 2w + w$: a eia ka hoohalike,

$$4w + 2w + w = 175.$$

Ina e hanaia kekahi o keia mau hoohalike, e loaa auanei ilaila ke kumukuai o ka mea i hoailonaia e ka w. A loaa ia kumukuai, e hiki no ma ia kumu ke loaa na mea e ae. E aho hoi ka maopopo o keia hoohalike mahope.

He okoa no ke kumu o ka w ma keia mau hoohalike. Ma ka hoohalike mua, he 100 dala ia, oia ke kumukuai o ka wati ka mea i hoailonaia malaila; ma ka lua o ka hoohalike, he 50 dala o ka w, no ka mea, malaila i hoailona ai ka w i ke kaula; a ma ke kolu, he 25 dala o ka w, no ka mea, malaila i hoailonaia'i ke ki.

I mea e loaa'i ke kumu o ka mea i ike ole ia, ma na huahelu, ua kakau kaawaleia oia ma kekahi aoao o ka hoohalike, aole i hoonuiia, aole hoi i puunaueia e kekahi mea e ae: a ma kela aoao o ka hoohalike, ua kakauia na mea i ikea.

PAUKU 11.

No ka hookaawale ana i na heluna.

1. Haawi kekahi kanaka i na dala he 381 e kuai i ka lio a me ke kaa; o na dala o ka lio he hapalua ia o ko ke kaa. Heaha kumukuai o kela a me keia?

O ka w ka hoailona no ka lio. Alaila, $2w$ ka hoailona no ke kaa; a o ka $w + 2w$ ke kumukuai o ia mau mea a elua. Nolaila, eia ka hoohalike,

$$w + 2w = 381.$$

E houluulu i na w, $3w = 381.$

E puunaue ma ke 3, $w = 127$, na dala o ke lio.

A o ke kaa, $2w = 254$, na dala o ke kaa.

No ka loaa o ka lua o ka hoohalike, o ke $3w = 381$, *ua houluluia na hua a pau o ka mea i ike ole ia iloko o ka hua hookahi.*

Alaila, e puunaue kakou i ka hoohalike i ke 3, i mea e ikea ai ke kumu o ka w; no ka mea, ina ua like $3w$ me 381, o ka w, ua like ia me ka $\frac{1}{3}$ o 381; oia keia, *ua lilo ka heluna o ka mea i ike ole ia i mahele e puunaue ai i na hua o ka hoohalike.*

Ma ka nui o na hana ana, *Ina i hoonuiia ka mea ike ole ia me kekahi huahelu, e pono ke puunaueia na hua e ae a pau e kela huahelu.*

2. Ke haawi nei au i ka hoohalike $a\,m + h\,m = 38$. No ka mea, o ka aoao mua o ka hoohalike, o $a\,m + h\,m$, oia ka huina o $a + h$ i hoonuiia me ka m, e hiki no ke kakauia penei, $(a + h)\,m$, a o ka $a + h$ ka heluna o ka m.

$$\begin{aligned} a\,m + h\,m &= 38 \\ (a + h)\,m &= 38 \\ m &= \tfrac{38}{a+h}. \end{aligned}$$

Ina o ka $a = 10$, a o ka $h = 9$, a e kau ia mau hua ma kahi o ko laua mau hoailona, alaila,

$$\begin{aligned} 10\,m + 9\,m &= 38 \\ (10 + 9)\,m &= 38 \\ m &= \tfrac{38}{10+9} = 2. \end{aligned}$$

* 3. He mau hoa kuai o A laua o E, a loaa ia laua $141, a o ko E puu he palua ia i ko A. Ehia na dala o keia a me kela?

E kau i	$m =$	ka puu o A.
Alaila,	$2\,m =$	ka puu o E.
E hui pu	$m + 2\,m = 141.$	
E hookui	$3\,m = 141.$	
Puunaue i 3	$m =$ 47	ka puu o A.
Pahu i ka E	$2\,m =$ 94	ka E puu.

4. Puunaue aku la kekahi i na alani he 70 na na keiki 4. I ka mua he puu; a i ka lua he palua, i ke kolu he pakolu, a i ka ha he paha i ko ka mua. Ehia na alani i keia mea i kela mea?

*5. I aku kekahi kanaka i kana keiki, O na makahiki o kaua i huipuia, he 78 ia, a he palima na makahiki o'u i kou mau makahiki. Ehia na makahiki o kekahi o kekahi?

E kau i $m =$ na makahiki o ke keiki.
Alaila, $5\,m =$ na makahiki o ka makua.
E hui, $5\,m + m = 6\,m = 78$.

*6. He mau hoa kuai o A, E, a me I, a loaa ia lakou $696, ua oi pakolu na dala o E imua i ko A puu; a ua like na dala ia I me na puu o A laua o E i hui pu ia. Ehia na dala o kekahi o kekahi?

He $m =$ ko A mau dala.
Alaila, $3\,m =$ ko E mau dala.
A he $3\,m + m = 4\,m =$ na dala o I.
A he $m + 3\,m + 4\,m = 696$.

7. Hoolima'ima kekahi i na paahana ekolu, i elua kanaka a me kahi keiki; uku aku no ia i 5 silina no kekahi kanaka, i 4 silina no kela kanaka, a i ekolu silina no ke keiki no ka la hana hookahi. A pau ka hana, loaa ia lakou na dala he 54. Ehia na la i hana pu ai lakou?

E hoailonaia na la i ka w. He $5\,w$ silina ka ke kanaka mua, he $4\,w$ silina ka kela kanaka, a he $3\,w$ silina ka ke keiki; a hui pu ia na silina o lakou a pau iloko o $54, he 324 ia o na silina.

$$5\,w + 4\,w + 3\,w = 324.$$

8. Kuai kekahi i na lio, na bipi, a me na hipa i na dala 632. Ua like ka helu ana o kela poe keia poe. He $47 ko kekahi lio, he $25 ko kekahi bipi, a he $7 ko kekahi hipa. Ehia na holoholona o kela poe o keia poe?

9. He aie ka kekahi i $3597. Na A kekahi puu dala

aie. Na E he palua i ka A; na I he like na dala aie me ko A laua o E; a na O he like na dala aie me ko E laua o I. Ehia na dala aie i ko kekahi i ko kekahi?

10. Kuai kekehi keiki i na alani 2, me na laime 3, a me na ohia 4, a make na keneta he 22 ilaila. Ua like na ohia 2 ma ke kuai ana me kekahi laime, a ua palua ke kumukuai o ka alani i ko ka laime a me ka ohia. Ehia na keneta no na alani, a no na laime, a no na ohia?

* 11. Ua palua na makahiki o A i ko E; a ua pakolu na makahiki o E i ko I; a o ka huina o ko lakou mau makahiki a pau, he 140 ia. Ehia o kekahi o kekahi?

* 12. Kuai kekahi i ka puu wahie i na dala he 104; make kekahi hapalua o ia puu i $6 no ka paila; a make hoi kekahi hapalua i $7 no ka paila: ehia na paila iloko o ua puu wahie la?

O ka w = ka hapalua o na paila.
Alaila, $6w + 7w = 104$.

13. Kuai kekahi i na ope lole like i ekolu $366; he mau apa iloko o kela ope keia ope: ma ke ope mua, uku aku la ia i $19 i kekahi apa oloko; ma ka lua, i $20 no ka apa; a ma ke kolu, i $22 no ka apa. Ehia na apa iloko o ua mau ope la?

* 14. Ina e hiki i kekahi mea kapili pohaku hale, ke kapili i na pohaku he 50 i ka hora hookahi, a i kekahi aku i 60, a i kekahi aku i 70, ehia na hora e hiki ia lakou a ekolu ke kapili i na pohaku he 1800?

15. Kauoha ke kanaka make i kona waiwai he $60,000 no kana wahine, me na keikikane 3, a me na kaikamahine 2, a me kekahi keiki hanai. Ua palua ko kekahi kaikamahine i ko ka hanai; a o ko kekahi keikikane, ua like ia me ko ke kaikamahine a me ko ka hanai; a o ka ka wahine, ua palua ia i ko kekahi keikikane. Ehia na dala o kekahi o kekahi?

16. Ehia mau la e hana'i na kanaka 2 i na anana papo-

haku 387, ke hana kekahi i na anana 4, a o kekahi i na anana 5 i ka la hookahi?

He $m =$ na la e hana'i.

* 17. I kekahi makahiki ua loaa i na hoakuai $4755; ua oi pakolu ko E mau dala imua o ko A; a ua like ko I mau dala me ko A laua o E; a ua like ka O i loaa, me ko E laua o I. Ehia na dala o kela a me keia?

18. Iloko o kekahi pahu wai he 264 na galani wai: a ma kekahi puka kahe, e kahe ana na galani 2 i na minute he 15; a ma ka lua o ka puka e kahe ana no na galani 5 i na minute he 30, a ma ke kolu o ka puka, e 3 mau galani i na minute he 45. Ehia na hora e kahe ai ka wai ma ia mau puka ekolu, a pau ka wai?

* 19. Holo aku kekahi moku mai Hawaii a Kauai, e holo ana i na mile 9 i ka hora hookahi; ia manawa no holo hoi kekahi moku mai Kauai a Hawaii, e holo ana i na mile 7 i ka hora 1, a he 224 na mile mawaena o laua i ka holo mua ana; ehia na hora e holo ai laua a halawai ma ka moana?

20. Houluulu na keiki 4, o A, o E, o I, a o H, i na dala o lakou; a o ka huina he $30. O keia puu dala, ua oi pakolu ko A imua o ko E. O ko I mau dala, ua like ia me ko E, a me ka $\frac{1}{3}$ o ko A. A o ka H mau dala, ua like ia me ko A a me ka $\frac{1}{2}$ o ko I. Ehia na dala o kela keiki o keia keiki?

He $m =$ na dala o E.

Alaila, $3\,m =$ na dala o A.

$m + \frac{3m}{3}$, oia $2\,m =$ na dala o I.

A $3\,m + \frac{2m}{2}$, oia $4\,m =$ na dala o H.

Nolaila, $m + 3\,m + 2\,m + 4\,m = 30$.

21. Ua pahiku na makahiki o ke kane, a ua palima hoi na makahiki o kana wahine i ko ke keiki e lua; a he 16

na makahiki e oi ana ko ke kane imua o ko ka wahine. Ehia na makahiki o ke keiki?

22. Kauoha kekahi kanaka make, na kana keikikane ka waiwai pakolu i ko ke kaikamahine, a e palua hoi ka waiwai o kana wahine i ko na keiki a elua a laua. Ma ia kauoha, he $8235 ko ka wahine i oi aku imua o ko ke keikikane. Ehia na dala o kekahi o kekahi?

24. Kuai kekahi i ka lio, i ke kaa, a me ka hale i na dala 800. O ke kumukuai o ka lio, he $\frac{1}{4}$ ia o ko ke kaa; a o na dala o ke kaa, ne $\frac{1}{5}$ ia o ka hale. Heaha ke kumukuai o kela mea keia mea?

*25. E hele ana na kanaka elua ma ke ala hookahi; ke hele kekahi i na mile he 45 i ka la hookahi, a o kekahi i na mile he 30 ia la hookahi. Ehia mau la e hele ai laua, a kaawale na mile he 300 mawaena o laua?

*26. Ina e hele kekahi o laua ma ka hikina, a o kekahi ma ke komohana, i na la ehia e kaawale ai laua i na mile 300?

27. He 6 mau keiki a kekahi makua, a o ka huina o ko lakou mau makahiki, he 42 ia; a o na makahiki mawaena o ka hanau ana o kekahi a o kekahi, he like ia me na makahiki o ke keiki muli loa. Ehia na makahiki o kela keiki keia keiki a pau loa?

*28. Kuai kekahi i ekolu pahu waina like, he ano okoa na waina o kela pahu keia pahu. Uku aku la ia i na silina 7 no ke galani 1 o kekahi waina, a me na silina 8 no ke gal. o kekahi, a me na silina he 10 no ke gal. o kekahi; a o ka uku a pau, he $50 ia. Ehia na galani ana i kuai ai?

*29. Hoolimalima kekahi i na kanaka elua e hana i na anana papohaku he 105; ua paa i kekahi na anana 4, a i kekahi na anana 3 i ka la hana 1. Ehia mau la a laua i hana'i, a paa ka pa?

30. I ka hana ana a kekahi paahana, ua hoolilo aku ia i kela hebedoma keia hebedoma i na dala uku o na la hana

elua o ia hebedoma, a koe nona he $32 o na hebedoma hana 4. Ehia na dala uku o ka la hookahi?

31. Kuai kekahi i na barela vineka no na dala 84. Hookahi hapalua o na barela i make i $3 no ka barela 1, a hookahi hapalua hoi, pakahi na barela i $4. Ehia na barela a pau?

32. Kauoha kekahi kanaka i make i $21,546 no kana wahine, a me na keikikane 2 a me na kaikamahine 2, penei; he $\frac{1}{5}$ no ka wahine, a ua like na dala o kekahi keikikane me ko na kaikamahine a elua. Ehia na dala o kekahi o kekahi?

33. Ua puunaueia na alani he 54 na na kanaka ekolu, na A me E a me I. Na A ka hapakolu i ka E, a na I he hapalua ka nui o kana i ko laua mau puu. Ehia mau alani i kekahi i kekahi?

PAUKU III.

No ka hookaawale ana i na mahele.

1. Ua ukuia mai i kekahi i $18 o ka aie, a he $\frac{2}{3}$ ia o ka aie a pau. Ehia na dala o ia aie ana?

He w = ka aie a pau.

Alaila, $\frac{w}{3}$ he $\frac{1}{3}$ ia, a $\frac{2w}{3}$, he $\frac{2}{3}$ ia o ka aie.

Nolaila, $\frac{2w}{3} = 18$.

Ua hoikeia mai ma ka pauku 1, ina e hoonuiia na aoao a elua o ka hoohalike, a i puunaueia paha e ka hua hookahi, aole e hookahuliia ka like ana o na aoao ilaila. Nolaila, i mea e kaawale ai ka mahele o ka aoao mua,

E hoonui me ke 3; $2w = 54$.

E puunaue i ka 2; $w = 27$, oia na dala aie.

Ua hoonui mua ia ka hoohalike a pau me ke 3, oia ka

mahele o ka $\frac{2w}{3}$, alaila, e imi i ke kumu o ka w, e like me ia mamua.

Ua hoikeia ma ka Mok. 6. pauku 6, *Ua hoonuiia ka hakina me kona mahele, ma ke kaawale ana o ua mahele la.*

2. Heaha ka puuhuahelu, ke hui pu ia kona $\frac{1}{2}$ a me ke $\frac{3}{5}$ o ia mea; he 44 kona huina?

He m ka hoailona o ia puuhuahelu.

Alaila, $\frac{m}{2}$ = ka hapalua, a $\frac{3m}{5}$ = na hapalima ekolu.

Nolaila, $\frac{m}{2} + \frac{3m}{5} = 44$.

E hoonui me 2; $m + \frac{6m}{5} = 88$.

E hoonui me 5; $5m + 6m = 440$.

E hookui i na m; $11m = 440$.

E puunaue i ka 11; $m = 40$, oia ka puuhuahelu.

Mamua e hookaawale kakou i na mahele o ka hoohalike, ma ka hoonui pakahi ana i na hua a pau me na mahele, alaila, e imi i ke kumu o ka m e like me ia mamua.

3. Heaha ka puuhuahelu, a i hui pu ia me ia kona $\frac{1}{2}$, $\frac{3}{4}$, $\frac{2}{7}$, me $\frac{1}{14}$, e hiki aku kona huina i ka 146?

He m = ka puuhuahelu.

Alaila, $m + \frac{m}{2} + \frac{3m}{4} + \frac{2m}{7} + \frac{m}{14} = 146$.

E hoonui me ka 2; $2m + m + \frac{3m}{2} + \frac{4m}{7} + \frac{m}{7} = 292$.

E hoonui me ka 2; $4m + 2m + 3m + \frac{8m}{7} + \frac{2m}{7} = 584$.

E hoonui me ka 7; $28m + 14m + 21m + 8m + 2m = 4088$.

E hookui i na m; $73m = 4088$.

E puunaue i ke 73; $m = 56$, ka puuhuahelu.

Ua hoonuiia na hakina $\frac{3m}{4}$ a me $\frac{m}{14}$ ma ka puunaue ana i na mahele o laua i ka 2; a ua hoonuiia hoi na hakina

$\frac{3m}{7}$ a me $\frac{2m}{7}$ ma ka hookaawale ana i ko laua mau mahele.

I ka hookaawale ana i ka hoohalike i na hakina, e hoonui kakou i na hua a pau o ka hoohalike me na mahele a pau, e pakahi ana ka hoonui me kela mahele keia mahele.

4. I mai la o A, "Ina e hui mai oe me kuu mau makahiki i ka $\frac{1}{2}$ a me $\frac{3}{4}$ o na makahiki o'u, he 81 ka huina. E-hia na makahiki o'u?"

He w = na makahiki ona.

Alaila, $w + \frac{w}{2} + \frac{3w}{4} = 81$.

5. Ina e kuaiia na $\frac{2}{7}$ o ka moku i $4000, ehia na dala e make ai ka moku okoa?

6. E lawe ana kekahi i na manu e kalepa, halawai mai la kekahi me ia, i mai la, Aloha oe, a me kau poe manu he haneri. I aku la kela, Aole a'u haneri manu, aka, ina ia'u kekahi poe e like me keia, me $\frac{1}{2}$ hou aku o keia poe, me 2 manu hou aku, a me ka $\frac{1}{2}$ o ka manu, alaila, ua haneri lakou. Ehia ana mau manu?

$$w + w + \frac{w}{2} = 100 - 2\tfrac{1}{2}.$$

7. E ku ana kekahi laau maloko o ka wai, he $\frac{1}{3}$ o kona loa malalo o ka wai, a he $\frac{1}{4}$ maluna o ka wai, a o ke koena malalo ma ka lepo. A mai ka welau o ka laau, a hiki i ka lepo malalo o ka wai, he 14 mau kapuwai. Ehia mau kapuwai ka loa o ua laau la?

8. Heaha ia puuhuahelu, he 20 ka oi ana o kona $\frac{1}{6}$ imua o kona hapawalu?

He w = ua puuhuahelu la.

Alaila, $\frac{w}{6} - \frac{w}{8} = 20$.

* 9. A pau na $\frac{3}{5}$ o ko kekahi waiwai i ka lilo, koe iho no $978. Ehia ona mau dala mamua?

10. Noho iho la kekahi kanaka i $\frac{1}{3}$ o kona mau makahiki

ma Farani, a he $\frac{1}{4}$ o kona manawa ma Enelani, a he 20 mau makahiki hou aku ma Amerika. Ehia ona mau makahiki?

11. Heaha ia puuhuahelu, he 21 ka oi ana o kona $\frac{1}{3}$ imua o kona $\frac{2}{7}$?

12. Kuai kekahi i na busela palaoa he 75 na na kanaka 2. I kekahi o laua, lilo ae la ilaila he $\frac{1}{4}$, a i ka lua $\frac{2}{3}$ o kona palaoa a pau. Ehia ana mau busela palaoa?

13. Haawi aku la kekahi i $6 no na kanaka 3; i ka mua he $\frac{1}{3}$, i ka lua $\frac{1}{4}$, a i ke kolu $\frac{1}{6}$ o na dala a pau iloko o kona eke. Ehia mau dala iloko o ka eke?

14. Puunaue o A laua o E i $320 no laua; ua oi pakolu a me $\frac{2}{7}$ ko E puu dala imua o ko A. Ehia na dala ia laua i kekahi i kekahi?

15. I aku la o A ia E, "O kou mau makahiki ua oi palua me $\frac{3}{8}$ imua o ko'u; a o ka huina o ko kaua mau makahiki, he 54 ia." Ehia na makahiki o kela a me keia?

* 16, Ina e puunaue ae i $50 no na kanaka 2, e haawi ana i kekahi i $\frac{3}{7}$ o na dala i lilo i kela, ehia na dala o kekahi me kekahi?

17. Uku aku la kekahi malihini ma Honolulu i ka la mua o kona pae ana, i $\frac{1}{3}$ o kona mau dala, a i kekahi la ae, i $\frac{1}{4}$, a i kekahi la ae i $\frac{1}{6}$, a koe iho la $26. Ehia ona mau dala i kinohou?

18. Hoolilo iho la kekaki i $\frac{2}{3}$ o kona waiwai a pau i kumukuai, a poho iho la $\frac{2}{3}$ o ia kumukuai, a koe iho la $723 o ua kumu la. Ehia na dala o kona waiwai okoa i kinohou?

19. Hoomaka iho la kekahi kanaka i ka oihana kalepa i ka 21 o kona makahiki, a hala $\frac{3}{10}$ o na makahiki o kona ola ana, oki iho la ia i ke kuai ana; O ka manawa o kona kuai ana, he $\frac{2}{3}$ ia o kona mau makahiki a pau. Make iho la ia i ka makahiki hea o kona ola ana?

20. O na makahiki o A he $\frac{1}{2}$ ia o ko E, a o na makahiki o I he $\frac{1}{3}$ ia o ko A; a o ka huina o ko lakou mau makahiki a pau, he 120 ia. Ehia na makahiki o kekahi o kekahi?

21. Kawili iho la kekahi kanaka i na busela bale, me ka palaoa a me ke kulina he 90; o ka palaoa, he $\frac{2}{3}$ ia o na busela kulina; a o ka bale he $\frac{1}{3}$ ia o na busela palaoa. Ehia na busela o kela mea keia mea i kawiliia?

22. Uku aku la na kanaka ekolu i $98 i ke kuai lole: uku aku o E i $\frac{5}{8}$ o na dala a A i uku ai, a uku aku la o I i $\frac{1}{8}$ o na dala a E i uku ai. Ehia na dala a keia mea a kela mea i uku aku ai?

23. Ina e puunaue oe i $75 no na kanaka 2 ma ka like ana o ke 3 me 2, ehia mau dala e lilo i kela a i keia?

E loaa i kekahi 2 mau dala i ka loaa ana o 3 i kela; oia hoi he $\frac{2}{3}$ ko kekahi i ko kela.

Ina he m = ka puu dala o kekahi,

Alaila, $\frac{2m}{3}$ = ka puu o kekahi.

A he $m + \frac{2m}{3} = 75$.

24. E puunaue i $84 i na puu elua, ma ka like ana o ka 7 me ka 5.

25. O ka huina o na puuhuahelu 2 he 91 ia, a ua like kekahi me kekahi ma ka like ana o ka 4 me ka 9. Heaha ia mau puuhuahelu?

* 26. He mau hoakuai 3, o A, E, I, a ua loaa $780. Penei ka waiwai kuai o kela mea keia mea, he 2 apana ka A, he 3 ka E, a he 5 ka I. Pehea la e maheleia'i ka waiwai loaa?

He m = ka A.

Alaila, $\frac{3m}{2}$ = ka E.

A he $\frac{5m}{2}$ = ka I.

27. E puunaue i 234 i na puuhuahelu 4, e like ana me kekahi me kekahi, ma ka like o ka 5 me ke 6 me ka 7 a me ka 8.

28. E puunaue i ke 36 i na puu 3, i like pu ai ka $\frac{1}{2}$ o ka mua me ka $\frac{1}{3}$ o ka lua, a me ka $\frac{1}{4}$ o ke kolu.

29. E ku ana na kulanakauhale 4 penei, A—E—O—U.

O ka loa mai A aku a U, he 102 ia mile. Mai A aku a E, he like ia me ka loa mai O aku a U ma ka like ana o ka 2 me ke 3; a o ka $\frac{1}{4}$ o ka loa mai A a E, i huipuia me ka $\frac{1}{2}$ o ka loa mai O a U, ua like ia huina me ka pakolu o ka loa mai E aku a O. Ehia na mile mawaena o kela wahi a me keia wahi?

30. He mau kanaka kuai 2 o A laua o B. Ua like ko A kumukuai me ko B me ka like ana o ka 7 me ke 6. I ka makahiki mua o ke kuai ana, ua loaa ia A ka puu dala e like ana me ka $\frac{1}{6}$ o kona kumukuai: a poho iho la ka $\frac{1}{6}$ o ke kumukuai o B. I ka lua o ka makahiki, poho iho la $\frac{2}{5}$ o ka waiwai a pau o A; a loaa ia B ka puu dala e like ana me $\frac{2}{5}$ o ke koena o kona kumukuai. A hiki i ka makahiki 3, koe iho la ia laua pu $2450. Heaha ke kumukuai i kinohou o kela a me keia?

31. Kauoha mai la kekahi kanaka make i kona waiwai e mahele like ia no kana keikikane a me kana kaikamahine. A pau $\frac{2}{3}$ o ka ke keikikane puu waiwai i ka lilo, koe iho la no $7268. Ehia na dala o kekahi o laua i kinohou?

32. I ninauia kekahi i na makahiki o kana kaikamahine, i mai la, he $\frac{1}{4}$ kona i ko'u mau makahiki, a o na makahiki o kona makuwahine he $\frac{7}{8}$ ia o ko'u; a he 102 ka huina o ko makou mau makahiki a pau." Ehia na makahiki o ke kaikamahine?

33. Ua loaa i kekahi kanaka kuai he puu dala e like ana me ka $\frac{1}{4}$ o kona kumukuai; a mahope iho, poho iho la ka $\frac{1}{5}$ o kona waiwai a pau; a mahope aku loaa ia ia ka puu dala e like me ka $\frac{1}{2}$ o ke koena o kona waiwai. Alaila, he $3935. Ehia na dala o kona kumukuai i kinohou?

PAUKU IV.

Ka Hookaa ana.

1. Ina e haawi oe i $36 i na kanaka 2 a oi aku ka E he $12 imua o ka A; ehia na dala o kekahi o kekahi?

He w = ka A mau dala.
Alaila, $w + 12$ = ka E.
A. $w + w + 12 = 36$ ma ka haawina.
E. oia hoi, $2w + 12 = 36$ ma ka hookui ana i na w.

Ma keia hoohalike hope, $2w + 12 = 36$, oia keia, ua like $2w$ a 12 koe me ke 36. E hiki ke hookaawale i na mea i ikea o ka aoao mua, ma ka unuhi ana i 12 mailoko o na aoao a elua; penei,

I. $2w + 12 - 12 = 36 - 12$.

No ka mea, o ka $+ 12$ a me ka $- 12$ o ka aoao mua, ua hoonalo laua i kekahi i kekahi, e pono ke waiho ia mau mea; penei,

O. $2w = 36 - 12$.
U. eia hoi, $2w = 24$ ma ka unuhi ana i $- 12$.
H. $w = 12$ ka puu dala o A.
$w + 12 = 24$, ka puu o E.

E nana i na hoohalike E a me O; malaila e akaka ai, o ka $+ 12$ ua hookaaia mai ka aoao mua aku a ka aoao hope o ka hoohalike, me ka hoololiia o ke kaha $+$ i $-$.

Nolaila, *o ka lawe aku i ka mea io, a o ka hoopili mai i ka mea io ole kumu like ma kekahi aoao, hookahi no ke ano.*

O ka lawe ana i ka hua mai kahi aoao a kau ma kela aoao o ka hoohalike, ua kapaia oia, Ka Hookaa ana.

2. Maloko o na wahi eke elua he $187, aka he 25 dala ka oi o ko kekahi eke imua o ko kekahi. Ehia na dala maloko o keia a me kela?

He w = ko kekahi eke.
Alaila, $w + 25$ = ko kela eke.
A, $w + w + 25 = 187$ ma ka haawina.

*3 He puu dala uku ko na kanaka 2 o A laua o E, he $325. Aka, o na dala uku o A, ua oi aku i ko E he $87; Ehia na dala a kela a me keia i uku aku ai?

4. Haawi kekahi i na alani he 67 na kekahi mau makamaka 2, he 13 mau alani i emi o ka kekahi mahope o ka kekahi. Ehia mau alani a kela mea keia mea o laua?

He m = ka kekahi puu.
Alaila, $m - 13$ = ka kela puu.
A. $m + m - 13 = 67$, ma ka haawina.
E. $2m - 13 = 67$, ma ka hookui ana i na m.

No ka mea, $2m - 13 = 67$, nolaila, ua akaka he 13 ka oi o ka $2m$ imua o ke 67. Ina e hui mai i ka 13 i keia aoao i kela aoao, alaila,

O. $2m - 13 + 13 = 67 + 13$.

Aka, ua pono ke hoonalo iho ka — 13 me ka + 13 o ka aoao mua, i kekahi i kekahi; penei,

U. $2m = 67 + 13$;
H. $2m = 80$, ma ka hookui ana.
K. $m = \frac{80}{2} = 40$, ko ka puu mua.
A, $m - 13 = 27$, ko ka lua o ka puu.

E nana i na hoohalike E a me U, e like me mamua; a maopopo ilaila, ua hookaaia ka 13 o ka aoao mua, a lilo i ka aoao hope, me ka hoololiia o ke kaha — i +.

Nolaila, *o ka lawe ana i ka mea io ole, he like no ia me ka hookui ana mai i ka mea io kumu like.*

5. He mau hoakuai ekolu, o A, E, I; he puu dala 3981 ke kumukuai. He wahi puu dala ka A i kokua ai ilaila; a o ka E puu he $337 i oi aku imua o ka A; a emi iho ka I he $181 mahope o ka A. Ehia na dala a kekahi a kekahi i kokua ai ilaila?

6. Kauoha iho la ke kanaka make i $9931 no kana wahine, me ke keikikane a me ke kaikamahine; penei ka haawi ana, no ke keikikane na $ oi he 522 imua o ko ke kaikamahine, a e emi hoi ia he $592 mahope o ko ka makuwahine. Ehia na dala o kekahi a o kekahi?

7. E puunaue i ke 42 i na puu 4: i 5 ka oi o ka mua imua

o ka lua, a i 8 hoi kona emi ana malalo o ke kolu, a i 9 hoi kona oi ana imua o ka ha.

8. Ua hala aku la kekahi hololio, 5 mau la o kona holo ana i na mile he 60 o ka la hookahi, alaila, hahai aku la kekahi hololio e ae mahope ona, he 75 na mile o kona holo ana i ka la hookahi. Ehia mau la i holo ai keia hololio hope, a loaa aku ka mea holo mua ia ia?

He m = na la o ka holo ana. Alaila, hele ka hololio hope i 75 m mile; a o ka mua he 60 m mile o kona hele ana mahope o ka hele ana o ka hololio hope; a he 300 na mile mawaena o laua, (60×5) i ko ka mea hope hoomaka ana e hele. No ka mea, ua hookahi ko laua ala hele, ua like hoi ka loihi o ko laua hele ana; penei ka hoohalike,

A. $75\,m = 60\,m + 300.$

Maanei e kau ana ka mea ike ole ia ma na aoao a elua o ka hoohalike. Aka, *e pono ke hui pu ia na hua a pau o ka mea ike ole ia ma kekahi aoao, a o na mea ikeia hoi ma kela aoao.*

E like hoi me ke kau pauna ana, ina i hui pu ia ka mea kuai me na pohaku kau pauna, aole no e ike pono ia ka pauna ana o ka mea kuai ilaila. Aka, ina e hui pu ia na pohaku kau pauna ma kekahi aoao o ka mea kau, a o ka mea kuai hoi ma kela aoao, alaila e ikeia na pauna o ka mea i akaka ole kona mau pauna. Ua like me ia ke ano o keia hana, e kau i ka mea ike ole ia ma kekahi aoao o ka hoohalike, a me na mea i ikea ma kela aoao, alaila pono ka hana ana.

Ina e unuhiia ke 60 m mailoko mai o na aoao a elua, penei,

E. $75\,m - 60\,m = 60\,m + 300 - 60\,m.$

A i hoonalo kakou i ke $+ 60\,m$ a ka $- 60\,m$ o ka aoao hope; penei ka hoohalike,

1. $75\,m - 60\,m = 300.$

oia hoi $15\,m = 300$ ma ka unuhi ana.

$m = 20$, na la e holo ai a loaa aku

E nana i na hoohalike A me I, a e akaka ua hookaaia ka mea ikea ole, o 60 m mai ka aoao hope a ka aoao mua, me ka hoololiia o ke kaha + i —.

9. He 6 mau hora o ke kahe ana o ka wai noloko mai o ka pahu wai piha i ka wai, e kahe ana na galani he 12 i ka hora 1, alaila, ua ukuhi hou ia he wai hou maloko olaila he 21 na galani i ka hora 1. Ehia na hora o ia ukuhi ana a piha hou ua pahu la?

10. I ninauia kekahi i na makahiki ona, i mai la, "Ina e hui pu ia na makahiki he 52 me ka pakolu o ko'u mau makahiki, e like no ka huina me ka palima o ko'u mau makahiki." Ehia ona mau makahiki?

*11. I neia manawa e oi pakolu ana na makahiki o kekahi makuakane imua o ko ke keiki ana, a hala na makahiki hou aku he 20, alaila, e oi palua wale no na makahiki ona. Ehia na makahiki ko kela a me keia?

12. E manao ana kekahi e kuai i na apa lole he 6 dala o ka apa hookahi, aka, aole e hiki no ka oi he 12 dala o na apa imua o na dala ia ia: alaila, kuai aku la i na apa like e ae, he 5 dala o ka apa, a koe iho la na dala 6 ia ia. Ehia mau apa ana i kuai ai?

13. E puunaue i 64 i na puu elua, e like ai ka palima o ka mua me ka pakolu o ka lua.

He w = ka puu mua.

Alaila, he $64 - w$, ka lua o ka puu.

A he $5w = (64 - w) \times 3$, ma ka haawina.

A. oia hoi $5w = 192 - 3w$.

Aole no e like ana ka $5w$ me ka 192, he $3w$ i koe e like ai. Ina e hookuiia'ku $3w$ ma na aoao a elua o ka hoohalike, penei,

E. $5w + 3w = 192 - 3w + 3w$,

A e hoonalo i ka $-3w$ a me ka $+3w$, ma ka aoao hope, alaila, penei ka hoohalike,

1. $5w + 3w = 192$;

oia hoi $8w = 192$, ma ka hookui i na w.

$w = 24$, o ka puu mua.

$64 - w = 40$, o ka puu hope.

E nana ma na hoohalike A, me 1, o ka $-3w$ ua hookaaia oia mai ka aoao hope a ka aoao mua, me ka hooloiia o ke kaha — i +.

No kela mau hana i hala iho nei, ua akaka keia kumu; *E hiki ke hookaa i kekahi hua makemake mai kekahi aoao a i kela aoao o ka hoohalike me ka hooloiia o kona kaha.*

14. Aia e ku ana kekahi laau, he 4 mau kapuwai ma ka lepo malalo o ka wai, he $\frac{1}{3}$ o kona loa maloko o ka wai, a he $\frac{1}{2}$ hoi o kona loa maluna o ka wai. Ehia mau kapuai o kona loa?

15. He 8 mau pauna o ke poo o kekahi ia; ua like na pauna o kona hiu me ko ke poo, a me ka $\frac{1}{2}$ o kona kino, a ua like hoi na pauna o ke kino me ko ke poo a me ka hiu. Ehia na pauna o ka ia okoa?

He m = na pauna o ke kino.

A $\frac{m}{2} + 8$ = na pauna o ka hiu.

Alaila, $m = \frac{m}{2} + 16$.

16. I ninauia kekahi i na makahiki ona, a me ko kana wahine, i mai la, "He 4 mau makahiki o ka'u keiki muli loa; a o na makahiki o ka'u wahine, he palua ia o na makahiki o ke keiki, a me $\frac{3}{4}$ o ko'u iho; a o ko'u mau makahiki, ua like me ka huina o na makahiki o kuu wahine a o ka maua keiki." Ehia o ko laua mau makahiki?

* 17. He waina kuai ko kekahi kanaka: he 9 mau silina o ke galani o kekahi, a he 13 silina o kekahi waina ma ke galani. Manao iho la ia e hui pu i na galani he 100 o kela waina me keia waina, i make ai ke gal. 1 i na silina he

12. Ehia mau galani o kela, ehia hoi o keia e pono ai ke hu pu?

*13. Ehia mau galani waina, he 9 silina o ke galani e pono ke hui pu ia me na galani he 20, he 13 silina o ke galani 1, e hiki ke kuai i ke galani 1 i na silina he 10?

19. Hui pu iho la kekahi kanaka kuai i na galani waina, he 8 silina o ke gal. 1, me na gal. waina he 20, he 10 silina o ke gal. 1, manao iho la ia e hui aku ilaila i na galani hou, he 15 silina o ke galani 1, i pono ke kuai i ka huina, no $2 o ke galani. Ehia na galani o keia hui hou ana?

20. Ehia mau gal. wai e pono ai ke hui pu ia me na gal. waina he 35, he 9 silina o ke gal. 1, a me na gal. he 45, he 13 silina o ke gal. 1, i make ai ke gal. 1 o ka huina i na silina he 10?

21. Ua lilo $\frac{2}{3}$ o na dala o kekahi no ka ai, a me $\frac{3}{5}$ o ke koena no ka lole, a koe iho $150: ehia na dala ona i kinohou?

22. Heaha ka puuhuahelu, o kona $\frac{1}{3}$ a me $\frac{1}{4}$, ua oi ia he 35 imua o kona $\frac{1}{8}$?

*23. He $80 ia A, a pela hoi ia E. Ua oi palua a me $5 hou aku ka A i hoolilo ai imua o ka E; alaila, o na dala o A i koe, ua emi he $13 o ka hapalua o ko E. Ehia mau dala a keia a me kela i hoolilo aku ai?

24. E mahele i ke 84 i na puu elua, penei, a i unuhiia ka $\frac{1}{2}$ o ka puu uuku mailoko mai o ka puu nui; a i unuhiia hoi ka $\frac{1}{8}$ o ka puu nui mailoko o ka puu uuku, e like pu na koena.

He $m =$ ka puu nui.

a he $84 - m =$ ka puu uuku.

Alaila, $m - \frac{84-m}{2}$; he $\frac{1}{2}$ ia o ka puu uuku i unuhiia mailoko mai o ka puu nui; a he $84 - m - \frac{m}{8}$, he $\frac{1}{8}$ o ka puu nui i unuhiia noloko o ka puu uuku, a ma ka haawina, ua like ia mau mea.

$$m - \frac{84-m}{2} = 84 - m - \frac{m}{8}.$$

Eia na puu, 48 me 36.

E nana i ke kaha — mamua o ka hakina $\frac{84-m}{2}$, ua pili no ia i ka hakina okoa, aole i na huahelu mua wale no. Aole no kakou e unuhi i ka hapalua o ke 84, aka i ka oi ana o ke 84 maluna o ka — m. Nolaila, ina e kauia ke kaha — mamua o ke 84, a kaawale ka mahele, alaila, e hoololiia ke kaha — imua o ka m i +; ina aole pela, e nui loa ka mea unuhi, (e like me ke kumu o ka m ka nui loa,) mailoko o ka hua mua o ka hoohalike. Ina e kau ana ke kaha + imua o ka hakina $\frac{84-m}{2}$, aole no e pono ke hoololi i ke kaha — imua o ka m i +. [E nana i ka mokuna 6, pauku 3.]

25. E mahele i ke 72 i na puu like ole, penei, ina $\frac{3}{4}$ o ka puu uuku e unuhiia mailoko mai o ka puu nui, e like ke koena me $\frac{2}{3}$ o ka mea i koe mahope o ka unuhi ana i ka mea oi o ka puu nui maluna o ka puu uuku, mailoko mai o ka puu uuku.

26. Hoouka aku la na kanaka elua, o A laua o E i na kumukuai ma kekahi moku kalepa; o ka A kumu he $\frac{5}{6}$ ia o ka E. Ua waiwai o A, a ua poho ka E na dala he 23: alaila, o na $\frac{7}{8}$ o ke koena a E i unuhiia mailoko o ka A, ua like ia me ka $\frac{1}{2}$ o ka A kumukuai. Ehia mau dala a kekahi a kekahi i hoouka ai?

27. Kuai kekahi i ka wati a me ke kaula o ka wati i $160. Ina e unuhiia na $\frac{3}{4}$ o ke kumukuai o ka wati mailoko mai o ka pa 6 o ke kumukuai o ke kaula; a i unuhiia hoi na $\frac{5}{12}$ o ke kumukuai o ke kaula mailoko o ka pa 2 o ke kumukuai o ka wati, e like auanei na koena. Ehia na dala o ka wati, a o ke kaula?

28. I ninauia kekahi, o ka hora hea ia o ka la, i mai la, Ina e houluuluia me keia hora mahope mai o ka hora awakea, i kona $\frac{1}{2}$ me ka $\frac{1}{3}$ me ka $\frac{1}{4}$ a me ka $\frac{1}{5}$ o ia hora, e like

kona huina me na hora mai keia hora aku a ke aumoe. O ka hora hea ia o ka la?

29. He elua mau puuhuahelu e like ana kekahi me kekahi ma ka like ana o ke 3 me ka 4; aka, ina e hookuiia mai ka 24 me keia puu me kela puu, alaila e like laua kekahi me kekahi ma ka like ana o ka 4 me ka 5. Heaha ia mau puuhuahelu?

*30. Heaha ia puuhuahelu, ina e huiia mai ka 5 me ia, a i hoonuiia hoi ia me ka 5, e like ana ka huina hoonui me ka pa 4 o ka huina hookui?

31. Ua pau i ka lilo ka $\frac{1}{3}$ a me $10 o ko kekahi kanaka mau dala, a koe iho la ka $\frac{1}{2}$ a me $15 hou aku o na dala i kinohou. Ehia na dala ia ia mamua?

*32. Heaha ia puuhuahelu, ina e puunaueia ia mea i ka 16, alaila, e hookui i ka mahele me ka puuokoa a me ka puuhapa, a e hiki aku ka huina i ke 84?

PAUKU V.

Na ui hoomahuahua i ka ike.

1. Heaha ka puuhuahelu, ina e huiia mai me ia ka $\frac{1}{2}$ me ka $\frac{1}{3}$ a me ka $\frac{1}{4}$ o ia puuhuahelu, he 50 ka huina?

2. I ninauia kekahi, ehia ona mau makahiki, i mai la ia, "He 5 mau makahiki ka oi ana aku o ka $\frac{1}{3}$ imua o ka $\frac{1}{4}$ o ko'u mau makahiki?" Ehia ona mau makahiki?

3. Uku aku la kekahi i $94 i na kanaka 3; i ka mua he $\frac{1}{3}$, i ka lua he $\frac{1}{4}$, a i ke kolu he $\frac{1}{4}$ o kona mau dala a pau. Ehia ona mau dala?

4. E imi i na puuhuahelu elua e like ana kekahi me kekahi, ma ka like ana o ka 2 me ke 1; alaila, a i hookuiia mai ka 4 me laua, alaila, e lilo ko laua like ana me ko ke 3 a me ko ka 2.

5. I ka hana ana i kekahi pauda, ua kawili pu ia ka paakai kuni me ka luaipele, a me ka lanahu. He $\frac{2}{3}$ o na pauna a pau a me ka 10 hou aku o ka paakai; he $\frac{1}{6}$ o ka mea a pau me ka emi o na pauna $4\frac{1}{2}$ o ka luaipele; a o na pauna lanahu he $\frac{1}{7}$ o ka paakai me ka emi o na pauna 2. Ehia na pauna o ka pauda?

*6. I ninauia kekahi, o ka hora hea keia, i mai la ia, "O na hora i hala mai ke awakea mai, ua like me na $\frac{1}{4}$ o na hora i koe a hiki i ke aumoe." O ka hora hea ia?

He $m =$ ka hora.

Alaila, $12 - m =$ na hora i koe a ke aumoe.

A o ka $m = \frac{48-4m}{5}$.

7. E holo ana kekahi moku i na mile he 10 i ka hora hookahi, a mamua ona e holo ana kekahi moku e ae, 8 mile i ka hora hookahi; he 18 na mile mamua. Ehia mau hora o ka holo ana, a loaa aku keia moku i kela?

8. Heaha ia mau puuhuahelu elua, e like ana kekahi me kekahi me ko ke 3 i ko ka 2; a ua like ko laua huina houluulu me ka $\frac{1}{6}$ o ko laua huina hoonui?

He $w =$ ka puu nui; alaila, $\frac{2w}{3} =$ ka puu uuku, a o ka $w + \frac{2w}{3} =$ ko laua huina houluulu.

A o $\frac{2w}{3} \times \frac{w}{1} = \frac{2w^2}{3}$; oia ka huina hoonui o ia mau puu 2; a o ka $\frac{1}{6}$ o ka $\frac{2w^2}{3} = \frac{2w^2}{18}$, oia hoi $\frac{w^2}{9}$.

Alaila, $\frac{w^2}{9} = w + \frac{2w}{3}$, ma ka haawina.

A, $w^2 = 9w + 6w$, ma ke kaawale ana o na mahele.

He hoohalike keia o ka papa 2, no ka mea, iloko olaila ka papa 2 o ka mea i ike ole ia, o ka w^2. Aka, ina e puunaueia na hua a pau i ka w, alaila e loaa ka

$$w = 9 + 6 = 15.$$

A he hoohalike ia o ka papa mua.

Eia na puuhuahelu, 15 me 10.

9. E puunaue i ke 48 i na puu elua, i oi pakolu kekahi puu maluna o ka 20, imua o ka emi ana o kela puu malalo o ka 20.

10. Haawi aku la kekahi kanaka i $1000 i kana wahine me ke keikikane a me ke kaikamahine, penei; ua oi aku ka ka wahine he $200 imua o ka ke keikikane, a ua oi aku ka ke keikikane he $100 imua o ka ke kaikamahine. Ehia na dala i kekahi i kekahi?

11. Kauoha aku la kekahi kanaka make i $11000 no kana wahine, na keikikane elua, a me na kaikamahine ekolu. Ua oi palua ka ka wahine puu dala imua o ko kekahi keikikane; a ua oi palua hoi ko kekahi keikikane imua o ko kekahi kaikamahine. Ehia na dala i kela mea keia mea o lakou?

12. Ua puunaueia kekahi pahu dala no na kanaka 3, penei; ua emi iho ko ka mua he $1000 malalo o ka $\frac{1}{2}$ o na dala a pau; a ua emi ko ka lua he $800 malalo o ka $\frac{1}{3}$; a ua emi ko ke kolu he $600 malalo o ka $\frac{1}{4}$ o na dala a pau. Ehia na dala a pau? ehia hoi i kela kanaka i keia kanaka?

13. Kauoha kekahi kanaka make i kona waiwai no kana mau keiki eha, penei; o ko A puu, ua emi ia he $3000 malalo o ka $\frac{1}{2}$; ua emi hoi ko E he $1000 malalo o ka $\frac{1}{3}$; a o ko I he $\frac{1}{4}$ ia; a ua oi aku ko O he $600 imua o ka $\frac{1}{5}$; o ka waiwai a pau. Ehia na dala o ka waiwai a pau? ehia hoi i kela keiki i keia keiki?

* 14. I ninauia kekahi, ehia na makahiki o kana kaikamahine, i mai la ia, Ina e hoonuiia kona mau makahiki me ka 5, e like no ka emi ana o ka huina malalo o ke 40 me ka emi ana o kona mau makahiki malalo o ka 12. Ehia ona mau makahiki?

* 15. E mahele i ke 76 i na puu elua, a i puunaueia ka puu nui i ka puu uuku, i like ai ka puu hapa me ke 37.

He m = ka puu uuku.

A he $76 - m$ = ka puu nui.

A, $\frac{76-m}{m} = 37$.

* 16. Aia i kekahi kanaka na kiaha dala elua, a hookahi wale no poi no ia mau mea a elua. He 12 mau auneke kaupauna o ke kiaha mua: aia poiia i ke poi, ua palua kona mau auneke i ko kela kiaha; aka, ina e poiia ka lua o ke kiaha, alaila e pakolu kona mau auneke i ko ke kiaha mua. Ehia na auneke o ke poi; ehia hoi o ka lua o ke kiaha?

* 17. Ina e puunaueia kekahi puuhuahelu i ka 7, o ka huina o ka mahele, ka puuokoa a me ka puuhapa i houluuluia he 71 ia. Heaha ia puuhuahelu?

18. Heaha ia puuhauhelu, ua emi like kona $\frac{1}{8}$ malalo o ke 65 me ka oi ana o kona palua maluna o ke 640?

19. He 320 na mile mawaena o na kanaka 2, o A laua o E; a e hele ana laua e halawai; he 9 mau mile ka hele ana o A i ka hora 1, a e hele ana o E i na mile 7 i ka hora 1. Ehia na hora e hele ai laua a halawai? Ehia mau mile hoi ka hele ana o keia a me kela?

20. Ua like na dala loaa mai i na hoahanau elua i keia makahiki i kela makahiki. Ua pau ko ka mua i ka lilo, a me ka $\frac{1}{7}$ hou aku o kana aie ana. Aka koe iho la ka $\frac{1}{5}$ o ka ka muli iho i loaa'i, aole i lilo. A hala na makahiki he 10, uku aku la ka muli i ka aie a ka mua, a koe mai la na $160. Ehia na dala i loaa mai i kekahi o laua i ka makahiki 1?

21. Kanu iho la kekahi mahiai i ke kulina ma na kihapai 4. Ma ke kolu o ke kihapai, he oi na husela 9 imua o ka ka ha; ma ka lua, he 12 busela oi imua o ka ke kolu; ma ka mua, he 18 busela oi imua o ka ka lua; a ma na kihapai a pau he 6 busela oi imua o ka pahiku o na busela ma ka ha. Ehia na busela kulina a pau ma ia mau kihapai?

* 22. He like na puu dala i na kanaka elua. A lilo aku $39 o ko kekahi, a he $93 o ko kekahi, he $\frac{1}{2}$ wale no na dala o keia i koe i na dala o kela. Ehia na dala o kekahi o kekahi i kinohou?

23. Heaha ia puuhuahelu, a i hookuiia'ku ia me ka 24

me ke 36, e like ana na huina ma ka like o ka 7 me ka 9?

* 24. Ua ukuia kekahi paahana 3 silina me 6 peni i keia la i kela la ana i hana'i a pau; a i na la hana ole a pau ua lilo aku 9 mau peni i kela la i keia la. A pau kana hana ana, koe iho la nona £3 me 2s a me 9 peni. Ehia ona mau la hana ole?

* 25. Elua kanaka hana o A a o E, ua ukuia'ku no kela a me keia, he 400 dala, i keia makahiki i kela makahiki. Ua oi ko A i lilo he $40 imua o ka E i kela makahiki i keia makahiki; a hala na makahiki 4, koe iho la no laua pu he $400. Ehia na dala a keia kanaka a me kela i lilo ai i ka makahiki hookahi?

26. Haawi aku la kekahi kanaka i $315 i na kanaka ona i eha, penei, Ua like ko E me ko A, a me ka ½ hou aku; ua like ko I me ko A laua o E a me ka ⅓ hou aku; a ua like ko O me ko A, ko E, ko I, a me ka ¼ hou aku. Ehia na dala i kekahi i kekahi?

27. Heaha ia puuhuahelu, ina i hoonuiia ia me ka 4, alaila e unuhiia he 30 mailoko o ka huina hoonui; a i puunaueia ua puuhuahelu la i ka 4, a e hookuiia ma ke 30 i ka puuhapa, e like no ka huina o keia me ke koena o kela?

28. I ninauia kekahi ehia na makahiki ona, i mai la ia, Ina e hoonuiia ⅔ o ko'u mau makahiki me ⅕ o ko'u mau makahiki, e like no ka huina hoonui me ka pakolu o ko'u mau makahiki. Ehia ona mau makahiki?

29. He 2 mau puuhuahelu, he ⅔ kekahi o kekahi; aka ina e unuhiia he 50 mailoko o kela a me keia, alaila e hapa 2 kekahi o kekahi. Heaha ia mau puuhuahelu?

* 30. Iho aku la kekahi kanaka hooholowaa i ka muliwai, a hoi hou mai la i na hora 6. I ka holo ana ilalo me ke au ua hiki ke holo i na mile 9 i ka hora 1; aka, i ka hoi ana mai, mamua mai ona ke au, 3 wale no mile kona holo ana i ka hora 1. Ehia ana mau mile i holo aku ai, a hoi mai?

31. I ka hui pu ana o kekahi i ka waina a me ka waio-

hia maloko o kekahi pahu, o ka waina he $\frac{1}{2}$ ia me na galani hou aku he 25; a o ka waiohia he $\frac{1}{3}$ ia me na galani emi 5. Ehia na galani waina a me ka waiohia o ka huina?

32. Manawalea aku la kekahi i na kanaka ilihune 6. I ka mua, haawi aku la ia i ka $\frac{1}{4}$ o kona mau silina, e emi ana na silina 3; i ka lua haawi no ia i $\frac{1}{5}$ o ke koena, e emi ana na silina 4; i ke kolu haawi no ia i ka $\frac{1}{4}$ o ke koena; i ka ha, haawi no ia i ka $\frac{1}{3}$ o ke koena, e emi ana na silina 3; i ka lima haawi no ia i ka $\frac{1}{3}$ o ke koena, me na silina hou aku 2; a i ke ono, haawi no oia i ke koena a pau. Ua like na haawina i kela kanaka i keia kanaka. Ehia na silina ana i haawi aku ai i kekahi kanaka?

33. Maloko o kekahi muliwai e ku ana ka laau, 4 ona kapuai malalo ma ka lepo: i ka wa kaipiha, he $\frac{5}{6}$ o na kapuwai koe maloko o ka wai, a he $\frac{1}{3}$ o ka loa maluna o ka wai; aka, i ka wa kaimake, ua like na kapuai maluna o ka wai me na kapuai maloko i ke kaipiha. Ehia na kapuai o ka laau, a me na kapuai o ka piha ana o ke kai?

* 34. Heaha ia puuhuahelu, ina e hookui aku au me ia i ka 13, a mailoko mai o ka $\frac{1}{13}$ o ka huina e lawe no au i ka 13, e like kona koena me ka 13?

35. Ua hana na kanaka 3 o A o E a o I i na anana papohaku 318: ua paa na anana ia A, me na anana 6 ia E, a me na anana 5 ia I i ka la hookahi; ua oi palua na la hana o E imua o A, a ua $\frac{1}{2}$ na la hana o I i ko laua la i hui pu ia. Ehia na la hana o kekahi o kekahi?

36. Maloko o na pa 4 na hipa a kekahi kanaka: ma ka pa mua he $\frac{1}{3}$ o na hipa a pau, ma ka lua he $\frac{1}{4}$, ma ke kolu he $\frac{1}{6}$, a ma ka ha he 18 na hipa. Ehia na hipa a pau?

37. Ina e kuai kekahi i ka palaoa a piha kona pahu, ma ka 5 silina no ka busela 1, e pau loa auanei kona dala, aka i hoopiha ia i ka pahu i ke kulina, 3 silina 6 peni o ka busela 1, e koe no ka £1, me na silina 4. Ehia mau busela o ka pahu?

38. Ekolu kanaka kuai, o A, o E a o I, ua waiwai lakou ma ke kuai ana he $900. Penei ka puunaue ana ia lakou; ma ka like ana o ke 3 ia A, me ka 7 ia E, a me ka 5 ia I. Ehia dala ia i kela mea keia mea a ekolu?

*39. I aku la o Ioane ia Wilama, "ua oi pakolu ko'u mau dala imua o kou." Ae mai la kela, i mai la, Ina e haawi mai oe ia'u i $20, alaila e oi pahiku ko'u i kou. Ehia mau dala o kekahi o kekahi?

40. Ua oi aku ke kumukuai i ka alani he 5 keneta imua o ko ka ohia, a ua like ke kumukuai i na alani 8 me ke kumukuai i na ohia he $13\frac{5}{7}$. Heaha ke kumukuai i kekahi o ka alani a me ka ohia?

*41. Kuai na kanaka elua i na apa lole a pau iloko o kekahi pahu, he $5 o kekahi apa. Ua oi palua ka A i kuai ai i ka E: aka, ina he 5 apa hou aku ka E i kuai ai, alaila ua oi pakolu kana i ka A. Ehia mau apa a kela a me keia i kuai ai?

42. I ka wa i mare ai kekahi kane me kana wahine, ua like ko ke kane mau makahiki me ko ka wahine ma ka like ana o ke 6 me ka 5; a hala na makahiki 8 o ko laua mare ana, ua like ko ka wahine mau makahiki me ko ke kane, ma ka like ana o ka 7 me ka 8. Ehia na makahiki o laua i ka wa mare?

43. Ua oi aku ke kumukuai o ke kaa, he $44 imua o ko ka lio. Ina e unuhiia $\frac{4}{7}$ o ke kumukuai o ka lio mailoko mai o ko ke kaa, e like no ke koena me ke koena o na $\frac{2}{3}$ o ka oi ana o ke kumukuai o ka lio maluna o $84 i unuhiia mailoko mai o ko ka lio kumukuai. Ehia na dala o ka lio?

44. He 50 mau lele ana o ka dia i mua o ka ilio hahai, a i ka holo ana he 4 ona mau lele ana i ko ka ilio mau lele ana 3: aka, ua like na lele 2 o ka ilio me 3 o ka dia ma ka loihi. Ehia mau lele ana o ka ilio a loaa aku ka dia ia ia?

45. E pau kekahi kihapai ai i ka aiia e ke kanaka a me kana wahine i na la he 12 ke ai pu laua; a hala ke kane i kahi e, e lawa no ia na ka wahine e ai i na la he 30. Ehia na la e pono i ke kane wale no ke ai ia mea a pau?

He $w =$ na la e ai ai ke kane wale no. No ka mea, ina e ai pu ke kane me ka wahine, e pau no ia i na la he 12, e ai pu laua i ka $\frac{1}{12}$ o ia mala i ka la hookahi. No ka mea hoi, ina o ka wahine wale no ke ai, e pau no ka $\frac{1}{30}$ ia ia i ka la hookahi: a o ka $\frac{1}{12} - \frac{1}{30}$ e hoailona i ka mea e ai ai ke kane wale no i ka la hookahi. Aka, ina i ai oia i ka ai okoa i na w la, i ka la hookahi ua ai oia i ka $\frac{1}{w}$ o ia mea.

$$\text{Nolaila, } \frac{1}{12} - \frac{1}{30} = \frac{1}{w}.$$

* 46. I na e hana pu o A laua o E, e hiki ia laua ke hana i kekahi papohaku i na la 8; aka i kokua mai o I, e paa no ia i na la 5. I na la ehia e hiki ia I wale no ke hana a paa ia pa?

* 47. He 2 pukakahe o kekahi pahu wai. Ma kekahi puka e pau no ka wai i na hora 7, a ma kekahi hoi e pau ia na hora 9. I na e kahe ana ka wai ma na puka a elua, ehia mau hora a pau loa ka wai i ke kahe?

He $w =$ na hora e kahe ai ka wai.

Ma na puka a elua e kahe no ka $\frac{1}{7} + \frac{1}{9}$ o ka wai i ka hora 1. Ina e pau ka wai i na w hora, i ka hora 1 e pau no ka $\frac{1}{w}$ o ka wai i kahe.

$$\text{Nolaila, } \frac{1}{7} + \frac{1}{9} = \frac{1}{w}.$$

48. Ina e paa kekahi hale i ka hanaia e kekahi kanaka na la 7, a i kekahi kanaka aku i na la 8, a i kekahi aku i na la 9, ehia mau la e hana pu ai ia mau kanaka ekolu, a paa ka hale?

*49. E hiki i na kanaka 2 ke hana a paa kekahi papohaku i na la he 12. A e hiki no i kekahi wale no o laua ke hana a paa ia i na la he 20. Ehia mau la e pono ai i kela kanaka ke hana a paa ua pa la?

50. Ma kekahi ulu laau hua, he $\frac{1}{2}$ o lakou ka ohia, he $\frac{1}{4}$ ka pea, he $\frac{1}{8}$ ka pika, 7 mau laau niu, 3 fiku, a 2 kuawa. Ehia mau laau a pau o ua ululaau la?

51. I ninauia kekahi keiki i kona makahiki, i mai la ia, Ina e huiia mai me kuu mau makahiki ka $\frac{1}{2}$ me ka $\frac{1}{4}$ o kuu mau makahiki, me ka 20 hou aku, e like ka huina me ka pakolu o kuu mau makahiki. Ehia ona mau makahiki?

*52. He 40 na makahiki o kekahi makuakane, a he 8 ko ke keiki ana. Ehia na makahiki e koe, a oi pakolu wale no na makahiki o ka makua i ko ke keiki?

53. A loaa ia A laua o E kekahi aa dala: lawe aku no o A i \$2 me ka $\frac{1}{6}$ hou aku o ka mea e koe; a lawe no hoi o E i \$3 a me ka $\frac{1}{6}$ hou aku o ka mea i koe, a ua like na dala a laua i lawe ai. Ehia na dala a pau o loko o ka aa?

*54. He wahi puuhuahelu, iloko olaila na huahelu elua, a o ko laua huina houluulu, he 6 ia. Ina e hookuiia mai ka 18 i ua puuhuahelu la, o na huahelu o ka huina, e hookahi ana no laua me kela mamua, aka e lilo no ka hua hope i mua, a o ka hua mua i hope. Heaha ia puuhuahelu?

No ka mea, elua mau huahelu o ua puuhuahelu la, e kau ana ka mua ma kahi o na umi. E hoailona ia hua i ka m. A, no ka mea, he 6 ko laua huina, he $6 - m$ kela huahelu: a o ka puuhuahelu, he $10\,m + 6 - m$. Ina e hookuiia ka 18 i keia puuhuahelu, e lilo ka hua hope i mua a o ka mua i hope.

Nolaila, $10\,m + 6 - m + 18 = 10\,(6 - m) + m$.

Oia hoi $10\,m + 6 - m + 18 = 60 - 10\,m = m$.

$10\,m - m + 10\,m - m = 60 - 6 - 18$;

$$18\,m = 36.$$

$$\left.\begin{aligned} m &= 2 \\ 6 - m &= 4 \end{aligned}\right\} \text{ na hua helu.}$$

He 24 ka puahuahelu, a he $24 + 18 = 42$.

55. Heaha ka puuhuahelu, ina e unuhiia ka 27 mailoko mai olaila, ma ke koena e lilo ka puuhuahelu hope imua, a o ka puuhuahelu mua i hope?

56. Kuai lilo mai la kekahi i na busela kulina i 2 busela no ka dala 1, a mahope iho i na busela like, 3 busela o ka dala 1; a kuai lilo aku la ia i ke kulina, i 5 busela no na dala 3, a waiwai iho la ia ilaila he 10 na dala. Ehia na busela kulina a pau o ia kuai ana?

He w = na busela o kela kuai ana a o keia kuai ana.

Alaila, $\frac{w}{2}$ = ke kumu mua o ke kuai lilo mai.

A $\frac{w}{3}$ = ke kumu o ka lua o ke kuai ana mai.

$\frac{w}{2} + \frac{w}{3} + 10$ = na dala i lilo a me ka waiwai ana.

No ka mea, kuai lilo aku la ia i na busela 5 no na \$3; ua make ka busela 1 i $\frac{3}{5}$ o ka dala; a o ka mea i loaa mai na ka 2 w busela, oia ka w busela o ke kuai mua a me ka lua o ke kuai lilo ana mai, he $\$\frac{6w}{5}$.

Nolaila, $\frac{5w}{6} = \frac{w}{2} + \frac{w}{3} + 10$.

He $54\frac{6}{11}$ na busela a pau.

57. He 2 kanaka hoolimalima o A laua o E; a ua like na dala loaa mai i kela a me keia o laua i ka makahiki. Aka he \$80 ka oi ana o ka E mau dala i lilo i mua o ka A: a hala na makahiki 4, ua aie o E i na dala 220. Ehia na dala o ka uku ja laua no ka makahiki?

58. A pau ae la ka $\frac{1}{5}$ o ko'u puu dala, a me ka $\frac{1}{5}$ o ke koena, he $96 e waiho ana aole i lilo. Ehia na dala mamua?

59. I ka hele ana o kekahi ma ka huakai, lilo aku la ka $\frac{1}{3}$ o kana puu dala ma ke kau wahi, o ka $\frac{1}{7}$ o ke koena ma kau wahi aku; he $\frac{4}{9}$ o ke koena ma kau wahi aku; a me $\frac{3}{5}$ o ke koena ma kau wahi aku; a koe iho la he 80. Ehia ona mau dala mamua?

60. E mahele i na 26 i na puu ekolu; a i hoonuiia ka puu mua me ka 2, a o ka puu 2 me ke 3, a o ka puu 3 me ka 4, e like pu ai na huina hoonui.

61. E mahele i ke 56 i na puu elua, a i puunaueia ka puu nui i ka 7, a o ka puu uuku i 3, e lilo ka huina o ko laua puuhapa i 10.

62. He 3 mau puka kahe o kekahi pahuwai, ma kekahi puka e pau ka wai i ke kahe i na hora 5, a ma ka lua e pau ia i na hora he 10, a ma ke kolu e pau hoi ia i na hora 8. Ina e kahe ka wai ma na puka a ekolu. Ehia hora e piha ai ka pahu?

63. I ninauia kekahi keiki i kona makahiki, i mai la ia, Ina e hoonui oe i $\frac{3}{4}$ o ko'u mau makahiki me ka $\frac{1}{12}$ o ko'u mau makahiki, e like no ka huina hoonui me na makahiki o'u. Ehia ona mau makahiki?

64. Ua haawiia ka aina i kuu makua e lilo nona i na makahiki he 99, a i kekahi manawa ua ninauia oia, ehia na makahiki o ia haawina i hala ae, i mai la kela, $\frac{2}{3}$ o na makahiki i hala, ua like ia me $\frac{4}{5}$ o na makahiki i koe. Ehia na makahiki i hala?

65, Heaha ia puuhuahelu e hiki ke maheleia i na puu like elua a i ekolu paha, a e like ana hoi ka huina hoonui o ia mau puu i hoomauia?

66. E a ana kekahi kahuhipa i kana poe hipa i ka manawa kaua, a halawai me ia kekahi poe koa, a hao i ka

½ o kana poe hipa, a me ka ½ o ka hipa hou aku; a hele iki ae, hao hou mai kekahi poe koa i ka ½ o ke koena a me ka ½ o ka hipa hou aku; pela no ke kolu a me ka ha o ka poe koa i hana mai ai, e lawe ana i ka ½ o ke koena a me ka ½ o ka hipa hou; a koe iho la nana na hipa 8. Ehia na hipa ia ia mamua?

67. He 2 mau lio o kekahi kanaka, a me ke kaa, he $150 o ke kaa. Ina e hoopiliia ka lio mua i ke kaa, o ke kumukuai o ua lio la a me ke kaa, ua palua ia i ko kela lio; aka, ina e hoopiliia kela lio i ke kaa, e oi pa kolu ke kumukuai o ia mau mea i ko ka lio mua. Ehia na dala o na lio a elua?

* 68. E mahele i 54 i na puu elua, a ina e puunaueia ka puu nui i ka 9, a me ka puu uuku i ke 6, e lilo ai ka huina o na puuhapa i 7.

69. Kuai lilo kekahi mahiai i ke kulina. Ua like na busela i lilo me na busela i koe ma ka like ana o ka 4 me ka 5. A pau na busela he 15 hou aku i ka aiia, ua like na busela i koe, me ka ½ o na mea i kuai lilo ia aku. Ehia na busela a pau mamua?

70. E mahele i ka 84 i na puu elua, a i puuuaueia ka puu nui i ke koena o ka puu uuku i unuhiia mailoko o ka puu nui, e lilo ai ka puu hapa i 4.

* 71. Ua ae like kekahi paahana me ka mea hale e hana i ka makahiki okoa, a e ukuia mai $72 a me na lole komo: a i ka pau ana o na malama 7 ua hookaaia oia me ka lole a me na dala he 32. Ehia na dala o ka lole?

72. Hoiliili kekahi paahana i na akere palaoa a me ka rai he 35. No ka akere rai 1, ua ukuia mai ia na silina 5, a no ka akere palaoa 1, ina he silina 1 hou aku mamua o kana mau silina i ukuia'i, ina ua like ia me ko ka akere rai ma ka like ana o ka 7 me ke 3. No ka hana a pau ua ukuia oia he £12. Ehia mau akere palaoa, ehia hoi o ka rai?

* 73. E hiki ke aiia kekahi aa palaoa a pau e ke kane a

me kana wahine i na la he 15. Ai pu laua ilaila i na la 9, alaila hele aku ke kane, a lawa no ka palaoa i koe na ka wahine i na la he 30. Ehia na la e lawa ai ka aa palaoa okoa i ka wahine wale no? ehia hoi i ke kane?

74. He 75 o kekahi poe kane, me na wahine a me na keiki. He 5 ka oi ana o na kane imua o na wahine. A o na kamalii, he 13 ko lakou oi imua o ka huina o na kane me na wahine. Ehia na kane, na wahine, a me na keiki?

75. Ua kuai na kanaka ekolu o A, E, a me I i na akere 10170. Ua emi na akere o E he 549 malalo o ko A; a ua oi aku na akere o I he 987 imua o ka E. Ehia na akere i kela a me keia?

76. I ninauia kekahi, ehia na dala ona, i mai la, Ina e hoonui oe i kuu puu dala me ka 4, a e hoonui mai i ke 60 ilaila, a e puunaue i ka huina i ke 3, alaila e unuhi i ke 45 mai loko mai o ka puuhapa, e like no ke koena me ko'u puu dala. Ehia na dala ia ia?

PAUKU VI.

Na mea ikea ole elua.

KA HOOKUIKAHI ANA MA KA HOOLIKE.

1. Kuai lilo ke kalepa i kekahi i na lemona 6 me na alani 3, he 42 keneta ke kumukuai; a i kekahi aku i 3 lemona a me na alani 8, he 60 na keneta. Ehia na keneta o kekahi lemona a o kekahi alani?

E hiki ke hoomaopopo i keia haawina ma ka mea ikea ole hookahi wale no: e aho hoi ke kakau i na mea ikea ole 2. *Ina ma ke ano o ka haawina, e pono na mea ikea ole elua, eia mua ka mea imi, i hoohalike iloko olaila ka mea hookahi i ikea ole.* Ua kapaia keia hana, *He hookui-*

kahi. He nui na ano o ka hookuikahi, a he pono ke ao maopopo na haumana ia mau ano a pau, no ka mea, i kekahi manawa ua komo lakou a pau iloko o ka hana hookahi.

He m = na keneta o ka lemona.
A o ka w = na keneta o ka alani.

A. Alaila $6\,m + 3\,w = 42$, ma ke kuai mua ana.
E. $6\,m = 42 - 3\,w$, ma ka hookaa ana.
I. $m = \frac{42 - 3\,m}{3}$, ma ka puunaue.
O. Eia hou, $3\,m + 8\,w = 60$, ma ke kuai hou ana.
U. $3\,m = 60 - 8\,w$, ma ka hookaa ana.
H. $m = \frac{60 - 8\,w}{3}$, ma ka puunaue.

No ka mea, *o na mea elua e like ana me kekahi mea e ae, ua like hoi laua kekahi me kekahi*, nolaila e hiki ke hana i hoohalike hou me ia mau mea i loaa iho nei ma na hoohalike I a me H; a iloko olaila he mea ikea ole hookahi wale no.

K, $\frac{42 - 3\,w}{6} = \frac{60 - 8\,w}{3}$,
L. $126 - 9\,w = 360 - 48\,w$, ma ka hoonui ana.
M. $48\,w - 9\,w = 360 - 126$, ma ka hookaa ana.
N. $39\,w = 234$, ma ka hookui ana i na hui.
P. $w = 6$, ke kumukuai i ka alani.

Ina e kau aku i keia kumu o ka w ma ka hoohalike I, ua loaa.

$$m = \frac{42 - (3 \times 6)}{6} = \frac{42 - 18}{6};$$

oia hoi, $m = \frac{42}{6} = 4$ ke kumukuai o ka lemona.

Ina elua mau mea ikea ole iloko o kekahi haawina, ina aole e hiki ke kakau iho i elua hoohalike, aole no e hiki ke hoakaka ia hana ana. Ma keia hookuikahi ana, *e imi kakou i ke kumu o kekahi mea ikea ole maloko o kela a me keia hoohalike, e hoolike ana i na kumu i loaa kekahi me*

kekahi. Malaila e loaa auanei ka hoolike hou, he mea ikea ole hookahi wale no iloko olaila.

*2. Aia no na kiaha dala 2, a me ke poi hookahi no laua. He $10 ke kumukuai o ke poi. Ina e poiia ke kiaha mua, alaila e oi palua kona kumukuai i ko ka lua; aka, ina e poiia ka lua o ke kiaha, alaila e oi pakolu ia i ko ka mua. Ehia na dala o kela kiaha, keia kiaha?

He $m =$ na dala o ke kiaha mua.
A he $w =$ na dala o ka lua.
Alaila $2\,w = m + 10$, ma ka haawina.

$$w = \frac{m + 10.}{2}$$

Eia hou, $w + 10 = 3\,m$, ma ka haawina.

$$w = 3\,m - 10,$$

A o ke $3\,m - 10 = \frac{m - 10}{2}$, ma ka hoolike ana i na kumu o ka m.

Eia ke kiaha mua, $10, eia ka lua $8.

*3. He 12 o ka huina houluulu o na puuhuahelu elua; ina e unuhiia ka pa 4 o ka puu uuku mailoko ae o ka pa 5 o ka puu nui, he 150 ke koena. Heaha ia mau puuhuahelu?

4. He lua mau puuhuahelu; ina e hookuiia mai i ka puu nui i $\frac{1}{2}$ o ka puu uuku, he 48 ka huina; aka ina e hookuiia ka $\frac{1}{2}$ o ka puu nui me ka puu uuku, he 42 ka huina. Heaha ia mau puuhuahelu?

5. He lua mau waina ano okoa; ina e pai pu ia a like a like ka pai ana, e make ke gal. 1 i na silina he 15; aka, ina e paiia na galani 2 o keia me na gal. 3 o kela waina, e make ke gala. 1 i na silina he 14. Ehia na silina o ke galani 1 o kela a me keia?

6. Ina e huiia mai ka 7 me ka hoohelu o kekahi hakina e like auanei kona kumu i 2 okoa: aka, ina e huiia ka 7 me ka mahele, e lilo auanei ia i $\frac{1}{4}$. Heaha ia hakina?

7. E imi i na puuhuahelu elua, a i hookuiia ka $\frac{1}{3}$ o ka mua me ka $\frac{1}{4}$ o ka lua, e lilo ka huina i 87, a e lilo ka $\frac{1}{5}$ o ka mua me ka $\frac{1}{6}$ o ka lua i 55.

8. I mai la o A ia E, I na makahiki 6 mamua ae nei, ua oi palua kou mau makahiki i ko'u; aka, i na makahiki 4 mahope aku nei, e like ko'u mau makahiki me ka $\frac{3}{8}$ o kou. Eia na makahiki o laua?

9. He wahi puuhuahelu, iloko olaila na huahelu 2; ina e puunaueia ua puuhuahelu la i ka huina houluulu o na huahelu oloko, e lilo ka puuhapa i 4; aka, ina e kauia ka hua hope o ka puuhuahelu imua, a o ka hua mua i hope, a e puunaueia ua puuhuahelu hou la i ka huina a me ka 1 hou aku, e lilo ka puuhapa i 6. Heaha ia puuhuahelu?

He m = ka huahelu mua.
a he w = ka huahelu hope.
Alaila $10\,m + w$ = ka puuhuahelu.

No ka mea, ma kahi o na 10 ka huahelu mua, nolaila ua hoonuiia oia me ka 10, i pono ai kona ano maoli.

$$\left.\begin{aligned} \frac{10m+w}{m+w} &= 4 \\ \frac{10w+m}{m+w} &= 6 \end{aligned}\right\}$$ ma na olelo o ka haawina.

10. Kuai lilo kekahi i na busela kulina he 10 a me na busela uala he 12 no na silina uku he 54; a i kekahi wa uku i 2 busela kulina a me na busela uala 4 no na silina he 14. Heaha ke kumukuai o ka busela kulina? Heaha hoi ko ka busela uala?

11. Haawi aku la kekahi makua i $9800 no kana mau keikikane elua. A hala kekahi manawa, ua lilo ka $\frac{1}{5}$ o ko A puu dala; a me ka $\frac{1}{6}$ o ko E; alaila ua like na puu dala i koe o laua. Ehia na dala i kela keiki i keia keiki i kinohi?

12. I aku la o A ia E, e homai no'u i na dala 6, alaila e oi pa 4 ko'u mau dala imua o kou. I mai la o E, e haawi mai oe i $3 no'u, alaila e like pu ko kaua mau dala. Ehia na dala o A? ehia hoi o E?

*13. Ina e lawe au i na ohia he 10 mai o A aku, e oi palua no na ohia i koe imua o ka E. Aka, ina haawi au i keia mau ohia lawe ia E, alaila e like ka laua mau ohia. Ehia na ohia ia A? ehia hoi ia E?

14. Ina e hoonui oe i ka puuhuahelu nui o na puuhuahelu elua, me ka 2, a i ka puuhuahelu uuku me ke 3, o ka huina houluulu o ko laua hoonui ana, he 101 ia. Ina e puunaue oe i ka puu nui i ka 4, a i ka puu uuku hoi i ka 5, he, 10 ka huina o ko laua mau puuhapa. Heaha ia mau puuhuahelu?

KA HOOKUIKAHI MA KA PANAI ANA

15. Kuai kekahi i ka iwilei paina, a me na iwilei 3 o ka lole kilika i $25; a mahope kuai no ia i na iwilei paina 4 a me na iwilei kilika 5 i $65. Ehia dala o kekahi iwilei paina, a o ka iwilei kilika?

He m = na dala o ka iwilei paina.
a he w = na dala o ka iwilei kilika.

A. Alaila, $m + 3w = 25$ ma ke kuai mua ana.
E. a, $4m + 5w = 65$ ma ke kuai lua ana.
O. $4m = 65 - 5w$, ma ka hookaa ana.
$m = \frac{65-5w}{4}$, ma ka puunaue ana.

Ano ina e panai aku kakou i ka mea i loaa e like ana me ka m ma kahi o ka m iloko o ka hoohalike A, alaila e loaa ka hoohalike hou me ka mea ikea ole hookahi.

U. $\frac{65-5w}{4} + 3w = 25.$
$65 - 5w + 12w = 100.$
$7w = 100 - 65 = 35.$
$w = 5$, na dala o ke kilika.

H. $m = \frac{65-5w}{4} = \frac{40}{4} = 10$ na dala o ka paina.

16. Uku aku la ka meahale i na silina he 42 i na paaua he 5 kanaka a me na keiki 3 no ka la hana 1; a i kekahi la ae, uku aku la i na kanaka 7 a me na keiki 5 i na silina he 62. Ehia na silina i kekahi kanaka? Ehia hoi i kahi keiki?

He m = na silina i ukuia'i ke kanaka.

A he w = na silina o ke keiki.

Alaila $5m + 3w = 42$, i ukuia i ka la mua.

$$5m = 42 - 3w.$$

$$m = \frac{42-3w}{5}.$$

Eia hou $7m + 5w = 62$, i ukuia i ka la iho.

$\frac{294-21w}{5} + 5w = 62$, ma ka panai ana.

$$294 - 21w + 25w = 310.$$

$$4w = 16.$$

$w = 4$, na silina o ke keiki.

$m = \frac{42-3w}{5} = \frac{42-12}{5} = \frac{30}{5} = 6$, na sili. o ke kanaka.

Pela no e hoomaopopoia'i na haawina mahope aku nei, oia penei, E imi mua i ke kumu o kekahi o na mea ikea ole ma ka hoohalike, a loaa, alaila e panai i ka mea i loaa ma kahi e kau ana ia mea ikea ole ma kela hoohalike. Ua kapaia keia hoonalo i kekahi mea ikea ole ma ka panai, *He hookuikahi ma ka panai.*

17. I aku la o A ia E; E haawi mai ia'u i na dala 8, a e oi palua ko'u mau dala i kou i koe; aka, ina e haawi aku au i $6 nou, alaila o ko'u e koe, he ¼ ia o kou. Ehia na dala ia A, a ia E?

18. He 2 mau lio i kekahi, a he kaa; o na dala o ke kaa he 250. Ina e hoopiliia ka lio mua me ke kaa, e oi palua aku ke kumukuai ia mau mea imua o ko kela lio: aka, ina e hoopiliia'ku ka lua o na lio me ke kaa, e oi pakolu aku ke kumukuai o ia mau mea elua i ko ka lio mua. Ehia na dala o kela lio, o keia lio?

19. Kuai lilo mai kekahi kalepa i na puu barela palaoa 2, no na dala he 576, o ka puu mua he $5 o ka barela 1, a o ka puu 2, he $6 o ka barela 1. Mahope kuai lilo aku la ia i $\frac{5}{8}$ o ka puu mua a me $\frac{4}{7}$ o ka puu alua i $358, a malaila waiwai oia i $11. Ehia mau barela iloko o kela puu keia puu?

20. Heaha ia Hakina, a i palua kona hoohelu, a e hookui mai hoi i ka 7 ma kona mahele, alaila e lilo ke ano o kona kumu he $\frac{1}{2}$: aka, ina e paluaia ka mahele, a e huiia mai ka 7 me ka hoohelu, ua lilo ia i 1.

21. I ninauia kekahi kumupalapala i ka loa a me ka laula o kona hale kula, i mai, Ina he 5 mau kapuwai hou aku ka laula, a he 3 mau kapuwai hou ka loa, ina ua 422 na kapuwai maloko o ka papa malalo, e oi aku ana imua o ko keia papa: aka, ina he 3 na kapuwai oi o ka laula, a he 5 o ka loa, ina ua oi na kapuwai he 400 o ka papa imua o keia. Ehia na kapuai o ua halekula la?

He m = ka loa.
He w = ka laula.

I mea e loaa'i na kapuai o kekahi papa, e pono no ke hoonui i ka loa me ka laula. Nolaila, $m\,w$ = na kapuai o ka papahale.

Alaila, $(m+5)+(w+3)=m\,w+400.$
a, $(m+3)+(w+5)=m\,w+422.$

22. Ina e hoopalahalahaia na aoao o kekahi hale 6 mau kapuai, alaila e like auanei kona laula me kona loa ma ka like ana o ke 6 me ka 7; aka, ina e laweia'ku na kapuai 6 mai kona mau aoao aku, alaila e like ka laula me ka loa ma ka like ana o ka 4 me ka 5. Ehia na kapuai o ka loa a me ka laula o ua hale la?

23. He puu huapalaoa, o na busela he 86, hookahi busela 4 silina 6 penei; ua kawili pu ia me ka rai, he 3s. 6 peni o ka busela rai; a ua huiia mai hoi ka bale 3s, o ka busela 1; a he 136 na busela o ka puu nui, a e pono no ke kuaiia

ka busela 1 o ia puu i na silina 4. Ehia na busela rai a me ka bale iloko i huipuia'i me ka palaoa?

24. Hahao kekahi kanaka i na pahu palaoa he 13 a me na ope lole he 33 iloko o kekahi halepapaa, a ua piha. Mahope lawe kela i na pahu palaoa 5, a me na ope lole 9, a ike aku la ia he $\frac{2}{3}$ o ka hale i koe i ka piha. Ehia na pahu palaoa wale no; ehia paha ope lole wale no e pono ke hoopiha ia hale?

25. Ina e hoonui oe i ka puu nui o na puuhuahelu elua me ke 3, a i ka puu uuku me ka 4, alaila e unuhi i ka huina hoonui uuku mailoko mai o ka huina nui, he 48 he koena; aka, ina e puunaue oe i ka puu nui i ka 4, a me ka puu uuku i ke 3, e lilo ka huina houluulu o ko laua mau puuhapa, i 14. Heaha ia mau puuhuahelu?

26. E hiki no ke uku i kekahi aie i na apana gula he 24, a me na apana dala he 40: a pau no hoi ka $\frac{1}{4}$ o ia aie i na apana gula 15 a me na apana dala he 15. Ehia na apana gula wale no, ehia hoi na apana dala wale no e hiki ke hookaa i ka aie?

27. I kekahi manawa haawi aku ka makuakane i $1384 na kana mau keiki 2: aka, i na paha i loaa i ke keiki mua ka $\frac{1}{2}$ wale no o na dala a ka makua i haawi ai ia ia, a loaa paha i ke keiki muli i ka puu dala e oi pakolu ana imua o na mea i loaa ia ia; alaila ua lilo ka huina puu dala o laua i $1777. Ehia na dala i kela a me keia?

28. Iloko o kekahi kihapai he 128 no roda aoaohalike, ua oi palua ka loa o ua kihapai la i kona laula, a ina he 4 mau roda hou aku kona loa, ina ua lawa ia i ka akere. Ehia na roda o kona loa a me ka laula?

KA HOOKUIKAHI ANA MA KA HOULUULU A ME KA UNUHI.

29. Kuai kekahi i na busela palaoa 3 a me na busela rai

5 no na silina he 38; a mahope kuai no ia i na busela palaoa 6 a me na busela rai 3 no na silina he 48. Ehia na silina o ka busela palaoa 1, a me ka busela rai 1?

He m = na silina o ka busela palaoa.
he w = na silina o ka busela rai.
A. alaila $3m + 5w = 38$, ma ke kuai mua.
E. a $6m + 3w = 48$, ma ke kuai lua ana.

Ina e hoouui kakou i na hua a pau o ka hoohalike A me 2, [e nana i ka pauku 1 o keia mokuna] alaila e loaa keia.

$$1.\quad 6m + 10w = 76.$$

Ina e uunuhiia ka hoohalike E mailoko mai o ka hoohalike I e lilo no ke koena i hoohalike hou, iloko olaila ka mea ikea ole hookahi wale no.

O. $6m + 10w = 76.$
U. $6m + 3w = 48.$

* $7w = 28$, ma ka unuhi ana.
$w = 4$. ke kumukuai i ka rai.

Ma ke kau ana i keia kumukuai ma kahi o ka wa maloko o kekahi hoohalike maluna, e loaa malaila ke kumu o ka m.

A. $3m + (5 + 4) = 38.$
$3m = 38 - 20 = 18.$
$m = 6$, ke kumukuai o ka palaoa.

Eia ka mea i hoonuiia'i ka hoohalike A me ka 2, i like ai ka heluna o ka m iloko o ka hoohalike A me ia iloko o ka hoohalike E, i mea e nalo ai ia mau hua ma ka unuhi ana.

30. Kuai kekahi keiki i na alani 7 a me na lemona 5, na keneta he 55; a mahope kuai ia me kona hoa i na alani 4 a me na lemona 3 i na keneta he 32. Heaha he kumukuai i kekahi alani, a i kekahi lemona?

He m = na keneta o ka alani.
He w = na keneta o ka lemona.

A. $7m + 5w = 55.$
E. $4m + 3w = 32.$

E hookuikahi i ka w. No ka mea aole e hiki ke hoonui i kekahi o ia mau hoohalike me ka huahelu e like ai na heluna o ka w, nolaila e pono ke hoonui i na hoohalike a elua me na huahelu e hookuikahi ai ia mau mea; penei.

I. $21m + 15w = 165$, ma ka hoonui ana i ka A me ka 3.
O. $20m + 15w = 160$, ma ka hoonui ana i ka E me ka 5.

$m \quad * \quad = 5$, ma ka unuhi ana.

E. $4 \times 5 + 3w = 32$, ma ka panai ana.
$3w = 32 - 20 = 12.$
$w = 4.$ Na alani 5 keneta, na lemona 4 keneta.

31. Uku aku la kekahi i $52 no na paa kamaa loihi 6, a me na paa kamaa uuku 8; a mahope aku he $32 no na paa kamaa loihi like 3, a me na paa kamaa uuku 7. Ehia mau dala o ka paa kamaa loihi I, a me ka paa kamaa uuku I?

He m = na dala o ka paa kamaa loihi.
w = na dala o ke kamaa uuku.

A. alaila, $6m + 8w = 52$
E. a $3m + 7w = 32$ } ma ka haawina.

I. $3m + 4w = 26$, ma ka puunaue ana i ka A me 2.

$3w = 6,$
$w = 2$, na dala o ka paa kamaa uuku.

O. $3m + (4 \times 2) = 26$, ma ka panai ana.
$3m = 26 - 8 = 18.$
$m = 6$, na dala o ka paa kamaa loihi.

Ua puunaueia ka hoohalike A me ka 2, i mea e like ai ka heluna o ka m, ma keia hoohalike me ka heluna o ka m ma ka hoohalike E i pono ai ka hoonaloia o ua mau hua la.

32. Ina e unuhiia ka palua o na dala o A mailoko o ka pakolu o na dala ia E, e lilo ke koena i $38; aka ina e

unuhiia ka palua o ko E puu dala mailoko mai o ka pakolu o ko A, he $83 ke koena. Ehia na dala ia laua?

He m = na dala ia A.
He w = na dala ia E.

A. Alaila $3w - 2m = 38$ }
E. a $3m - 2w = 83$ } ma ka haawina.

Ina e hoonui kakou i ka hoohalike A me ke 3, a i ka hoohalike E me ka 2, e like auanei na heluna o na hua m.

I. $9w - 6m = 114$, ma ka hoonui me ka 3.
O. $-4w + 6m = 166$, ma ka hoonui me ka 2.

$5w$ * $= 280$, ma ka houluulu.
a o ka $w = 56$, na dala o E.
E. $3m - 2 \times 56 = 83$, ma ka panai ana.
$3m = 83 + 112 = 195$.
$m = 65$, na dala o A.

No ka mea, he mau kaha like ole ko na hua o na hoohalike I me o, no ia mea, ua hoonaloia lakou ma ka *houluulu.*

No keia mau hana i hanaia iho nei, ua loaa ia kakou keia *kumu hana,* no ka hoonalo ana i kekahi o na mea ikea ole.

A maopopo ia oe kekahi o na hua ikea ole elua, e pono ke hookuikahi, e hoohalike i na heluna o na hua hoailona ia mea, ma na hoohalike a elua, i ka hoonui ana paha, a i ka puunaue ana paha.

Ina he like ole na kaha o ia mau hua, e hookui i na hoohalike: ina hoi e like ana na kaha, alaila e unuhi i ka mea uuku mailoko mai o ka mea nui.

Ina he akaka ole ka huahelu e hoonui ai, e hiki no ia ia ke hoonui i ka hoohalike me ka heluna o ka hua iloko o kela hoohalike e pono ke hoonalo ia.

33. I aku la o A ia E, Ina e unuhiia kou puu dala mai loko o ko'u, e like auanei ke $\frac{1}{3}$ o ke koena me na dala ia

oe: ina hoi e haawi mai oe ia'u i $2, alaila i oi palima ko'u mau dala imua o kou. Ehia na dala o kela a me keia?

34. He wahi puuhuahelu, iloko olaila na huahelu elua; ina e hookuiia mai ka 2 me ka huina houluulu o ia mau huahelu, e oi pakolu ka huina imua o ka huahelu mua; ina hoi, he 18 ke hookuiia mai i ua huina la, alaila e lilo ka huahelu hope i mua, a o ka huahelu mua i hope. Heaha ia puuhuahelu?

35. He mau puu dala 2 ko kekahi ma na koena elua, a he $25 maloko o kekahi eke. Ina e hahao aku a i ka eke dala ma ke koena mua, alaila he $\frac{5}{7}$ ia o ko kela koena; aka ina e hahao oia i kona eke maloko o kela keena; alaila, o na dala ma ke keena mua e like no ia me ko kela, ma ka like ana o ka 5 me ka 13. Ehia na dala ma kela keena ma keia keena?

36. Hoouka o A laua o E i waiwai kuai ma ka moku, a ua waiwai o A he $2, a ua poho ko E he $50 ilaila, a ua palua ko A i loaa mai i ka hoi ana mai o ka moku i ko E i loaa mai: aka ina i waiwai o E he $20, a poho paha o A he 50, ina ua pa 4 ka E i loaa mai ai i ka A. Ehia mau dala waiwai i hooukaia e kela mea keia mea?

37. Ua hui pu kekahi mahiai i ka puu bale me ka puu rai, a ike iho la kela, ina i oi aku na busela 6 o ka bale, a me na busela 6 o ka rai e hui pu ia, ina ua komo maloko o ka huina na busela 7 o ka bale ma na busela 6 o ka rai. Aka, ina he emi iho na busela 6 malalo o ka mea i komo o kela mea o keia mea, alaila ua komo na busela bale 6 mai na busela rai 5. Ehia na busela i huiia o kela mea keia mea?

38. No kekahi kanaka he wati gula, a me kekahi wati dala, a hookahi no kaula no ia mau wati; he $8 ke kaula. O ka wati kala a me ke kaula pu, ua like ko laua mau dala me ka $\frac{1}{2}$ o ko ka wati gula; aka, ina e hoopiliia ke kaula me ka wati gula, alaila ua oi pakolu kona kumukuai i ko ka wati kala. Ehi na dala o kela wati keia wati?

39. Maloko o kekahi buke, ina he 12 mau aoao pepa hou aku o ke pai ana, a he 3 mau lalani hou aku ma kela aoao a pau o ka buke, ina ua hoomahuahuaia oia i na lalani hou he 744 maloko; ina hoi i emi na aoao pepa o ia buke he 8, a emi hoi paha na lalani o kela aoao keia aoao a pau i 3 iho, ina ua emi na lalani a pau iloko o ua buke la he 680. Ehia mau aoao o ua buke la, a me na lalani o kekahi aoao?

40. He mau aina 2 no A laua o E, iloko olaila na akere he 502. Ina ua oi pa 4 ko A mau akere, a oi pa 3 ko E imua o ko laua i loaa, alaila ia laua pu na akere he 1924. Ehia mau akere ia A; ehia hoi ia E?

41. Ua oi aku ka aie a na kanaka elua imua o na dala e waiho ana ia laua. I aku la o A ia E, "E haawi mai oe ia'u i $\frac{1}{3}$ o kou mau dala, a e hiki ia'u ke hookaa i kuu aie." I mai la kela, "E haawi mai i ka $\frac{1}{2}$ o kou mau dala, alaila hiki ia'u ke hookaa i kuu aie." He $1500 ka A aie, a he $2125 ka E. Ehia na dala e waiho ana ia A? Ehia hoi ia E?

42. Kuai lilo mai kekahi i na pipe waina 2. Na kekahi galani o kahi pipe, uku aku la ia i na silina 8; a no ke galani o kela pipe, he 10 silina me 6 peni; a he $160 ke kumu kuai no na pipe okoa a elua. A kuai lilo aku la ia i na galani he 25 o kekahi pipe, a me na galani he 16 o kela pipe; a mahope hookui iho la ia i ka waina o na pipe a elua, a hui mai me ia na galani wai he $15\frac{3}{4}$. A mahope, kulu iho la na galani $5\frac{3}{4}$, o ka waina i koe ua kaa na silina 8 no ke gal. 1. Ehia mau galani o kela pipe keia pipe i kinohi?

43. He 32 mau galani vinega i kekahi kanaka iloko o na pahu elua. Manao iho la ia o hoolike a like ka vinega o kela pahu keia pahu, ninini aku la ia no loko o ka pahu mua a i ka pahu alua i na galani e like ana me na galani iloko o ua pahu lua la: alaila ninini aku la ia no loko o ka pahu alua a iloko o ka mua i na galani e like ana me na

galani iloko o ua mua la; a mahope ninini aku la ia no loko o ka pahu mua a iloko o ka pahu alua i na galani e like ana me na galani i koe iloko. Alaila ua like a like na galani vineka ma na pahu. Ehia na galani o ka pahu mua, a me ka pahu alua i kinohou?

PAUKU VII.

Ka mea ikea ole ekolu, a keu aku paha.

1. Kuai na keiki ekolu o A, o E, a o I i ka manawa hookahi. Kuai o A i na alani 4, me na laime 7 a me na lemona 5, no na keneta 51: Kuai o E i na alani 6, me na laime 8 a me na lemona he 10 no na keneta he 74: a kuai hoi o I i na alani 9, me na laime 3, a me na lemona 2 no na keneta he 58. Ehia na keneta o kekahi alani, laime a me ka lemona?

He m = na keneta o ka alani.
He n = na keneta o ka laime.
a he w = na keneta o ka lemona.

A. Alaila, $4m + 7n + 5w = 51$, ka A kuai ana.
E. $6m + 8n + 10w = 74$, ka E kuai.
I. $9m + 3n + 2w = 57$, ka I kuai.

E pono ke hoonalo pakahi ia keia mau mea ikea ole. E hiki ke hana ma kekahi o na hana hookuikahi o ka pauku 6. *O ka mea mua no ka unuhi mailoko mai o keia mau hoohalike* 3, *i na hoohalike e ae elua, e komo ana ilaila na mea ikea ole elua wale no.*

Ina e hoonui kakou i ka hoohalike A me ka 2, o ka heluna o w e like auanei ia me ia ma ka hoohalike E.

O. $8\,m + 14\,n + 10\,w = 102.$
E. $6\,m + 8\,n + 10\,w = 74.$

U. $2\,m + 6\,n \quad * \quad = 28$, ma ka unuhi ana.
H. $m + 3\,n = 14$ ma ka puunaue i ka 2.

Eia hou, ina e hoonui kakou i ka 1 me ka 5 e like no na heluna o w iloko o E a me I.

K. $45\,m + 15\,n + 10\,w = 290.$
L. $6\,m + 8\,n + 10\,w = 74.$

L. $39\,m + 7\,n \quad * \quad = 216$, ma ka unuhi ana.

Ua loaa ia kakou na hoohalike elua, o H, a me L he mau mea ikea ole elua wale no ko loko.

H. $m + 3\,n = 14.$
$m = 14 - 3\,n.$

Ina e panai kakou i keia kumu o m ma L, e loaa penei.

M. $39 \times (14 - 3\,n) + 7\,n = 216.$
$546 - 117\,n + 7\,n = 216$ ma ka hoonui ana.
$546 - 216 = 117\,n - 7\,n$, ma ka hookaa ana.
$330 = 110\,n.$
N. $n = 3.$

Ina e panai kakou i keia kumu o n ma ka H, ua loaa;

$m + (3 \times 3) = 14.$
P. $m = 14 - 9 = 5$, ma ka hookaa ana.

Ina hoi e panai kakou i na kumu o m a me n, me ia i hoikeia ma ka N, a me ka P, maloko o kekahi hoohalike mua iloko olaila ka w, e loaa auanei ia kakou ke kumu o kela mea no hoi. E lawe i ka 1 paha.

I. $9 \times 5 + 3 \times 3 + 2\,w = 58.$
oia $45 + 9 + 2\,w = 58.$
$2\,w = 58 - 45 - 9 = 4$, ma ka hookaa ana.
$w = 2.$

Eia, he alani 3 keneta;
he laime 3 keneta;
he lemona 2 keneta;

2. Kuai o A i na alani 5 me na pika 6 a me na pea 7 no na keneta he 75; a kuai hoi o E i na alani 8, i na pika 9 a me na ohia 5, no na keneta he 94; kuai o I i na alani 2, na pea 8, na ohia he 10, no na keneta 56; a kuai hoi o O i na pika 3, me na pea 6, a me na ohia 9, no na keneta he 48. Ehia na keneta no kekahi o kela mea kela mea?

He 4 mau mea ikea ole iloko o keia haawina; a e loaa auanei ko lakou mau kumu ma na hana ana i hoakakaia mamua. Aole no e komo na mea ikea ole a pau iloko o na hoohalike a pau.

He m = ke kumukuai i ka alani,
He n = na keneta o ka pika,
He p = na keneta o ka pea,
a he w = na keneta o ka ohia.

A. Alaila, $5m + 6n + 7p = 75$, ke kuai a A,
E. $8m + 9n + 5w = 94$, ke kuai a E,
I. $2m + 8p + 10w = 56$, ke kuai a I,
O. $3n + 6p + 9w = 48$, ke kuai a O.
I. $2m + 8p + 10w = 56$.

oia hoi, $2m = 56 - 8p - 10w$, ma ka hookaa ana.
U. $m = 28 - 4p - 5w$, ma ka puunaue.

A i panai kakou i keia kumu o m ma na hoohalike A a me ka E, ua loaa.

$5 \times (28 - 4p - 5w) + 6n + 7p = 75$, no ka hoohalike A.

$140 - 20p - 25w + 6n + 7p = 75$, ma ka hoonui ana.

H. $6n - 13p - 25w = -65$, ma ka hookaa, a me ka hookui.

Ua loaa hoi, $8 \times (28 - 4p - 5w) + 9n + 5w = 94$, no ka hoohalike E.

$224 - 32p - 40w + 9n + 5w = 94$, ma ka hoonui ana.

K. $9n - 32p - 35w = -130$, ma ka hookaa a me ka hookui.

Ua loaa ana na hoohalike 3, oia, U, H, a me K, iloko olaila na mea ikea ole ekolu wale no, o ka M, ka N, a me ka W.

Ina e hoonui kakou i ka hoohalike o me ka 2, e like auanei na heluna o ka n iloko o ka o a me ka H.

H. $6n + 12p + 18w = 96.$
O. $6n - 13p - 25w = -65.$

L. * $25p + 43w = 161$, ma ka unuhi ana.

Eia hou, ina e hoonui kakou i ka hoohalike o me ke 3, e like na heluna o ka n iloko o ka o a me ke K.

M, $9n + 18p + 27w = 144.$
K. $9n - 32p - 35w = -130.$

M. $50p + 62w = 274$, ma ka unuhi ana.

He elua wale no mea ikea ole iloko o na hoohalike L, a me ka N, a e hiki ke hookuikahiia ua mau mea la e like mamua.

Ina e hoonui i ka hoohalike L me 2, ua loaa,

P. $50p + 86w = 322.$
N. $50p + 62w = 274.$

* $24w = 48.$
$w = 2$, na keneta o ka ohia.

Ma ka panai ana i ke kumu o ka w ma kona wahi iloko o ka hoohalike M, ua loaa,

$50p + 124 = 274,$
oia $50p = 274 - 124 = 150.$
a $p = 2$, ke kumu kuai o ka pea.

Ma ka panai ana i ke kumu o ka P a me ka W maloko o ka hoohalike O, ua loaa.

o. $3n + 18 + 18 = 48$
oia $3n = 48 - 36 = 12.$
$n = 4$, na keneta o ka pika.

A ma ke kau ana i na kumu o ka n a me ka p iloko o ka hoohalike A, ua loaa,

$5m + 24 + 21 = 75.$
oia $5m = 75 - 45 = 30.$
$m = 6$, na keneta o ka alani.

Aia maopopo ke kumu o na mea ikea ole, pono no e panai aku ia mea ma kahi o ua mea ikea ole la maloko o kekahi hoohalike. Ua pono hoi ke hana i ka hookuikahi ana ma ka panai paha, a ma ka unuhi paha, a ma ka hoolike paha. E hiki no ma ia mau hana a pau, ke hoolike a me ka hookuikahi.

3. Kuai kekahi mahiai i na busela palaoa he 12, me na busela rai he 10, a me na bu. bale he 16, no na £9, me na silina 2, me kekahi kanaka; a kuai hou me kekahi i 7 busela palaoa, me na bu. rai he 20, a me na bu. bale he 10 no na £8, me na sil. 19; a kuai hoi me kekahi aku i na busela palaoa he 15, 8 hoi o ka rai, a he 20 hoi o ka bale, no na £10, me na sili. 15. Ehia na silina o kekahi busela palaoa; ehia o ka rai, ehia hoi o ka bale?

4. E puunaue i 125 i na puu 4, ina e hookuiia mai ka 4 me ka puu mua, a i unuhiia mai ka 4 mai loko o ka puu alua, a i hoonuiia ke 3 o ka puu me ka 4, a i puunaueia ka puu elima me ka 4; e like no ka huina, ke koena, ka huina hoonui a me ka puuhapa, kekahi me kekahi.

5. E imi i na puuhuahelu 3, a i hookuiia ka mua me ka $\frac{1}{2}$ o kela mau puu elua, a o ka lua me ka $\frac{1}{3}$ o kela mau puu, a o ke kolu me ka $\frac{1}{4}$ o kela mau puu, e hiki ai ka huina o ia mau mea i 34.

6. Ina e hiki ia A laua o E ke hana a paa kekahi hale i na la 8, a ia A laua o I i na la 9, ia E laua o I i na la he

10. Ehia mau la e hana'i hookahi kela mea keia mea o lakou a pau ia ha'e?

7. I aku la o A ia E laua o I, "Ina e haawi mai keia mea kela mea o olua i na $10, e like auanei kuu puu dala me ko olua e koe, ma ka like o ka 4 me ka 5." I aku la hoi o E ia A laua o I, "Ina e haawi mai keia mea kela mea o olua i na dala he 10, e like auanei kuu puu dala me ko olua e koe, ma ka like o ka 5 me ka 4." I aku la o I ia A laua o E, "Ina e haawi mai kela mea keia mea o olua i na $10, e palua kuu puu dala i ko olua e koe." Ehia na dala o kela a me keia a ekolu?

8. Puunaue iho la na kanaka 3 i ka puu dala penei; o ka huina o na puu ia A laua o E, he $900; o na puu o A laua o I, he $300; a o na puu o E laua o I, he $700. Ehia na dala o kela puu keia puu?

9. Olelo aku la kekahi kanaka, o kona mau makahiki i hui pu ia me ko ke kiki ana, ua oi aku ka huina he 16 imua o ko ka wahine ana. I mai la ka wahine, O ka huina o kona mau makahiki iho me ko ke keiki a laua, he 8 ia o ka oi ana imua o ko ke kane; a o ka huina o ko lakou mau makahiki a pau, he 88 ia. Ehia na makahiki o kela a o keia?

10. He elua mau hakina, ina e hookuiia mai ke 3 me ka hoohelu o ka mua, e oi palua ia imua o kela hakina; aka, ina e hookuiia mai ke 3 me ka mahele, e like no keia hakina me kela. Ina e houluuluia ua mau hakina nei, a e unuhiia hoi ka mea uuku mailoko ae o ka mea nui, e oi paiwa ka huina imua o ke koena. Ina e hoonuiia kekahi hakina me kekahi hakina, a hookui mai i ka 10 me ka hoohelu, e like no ke kumu o ka hakina i loaa me ko ka hakina mua. Heahi ia mau hakina?

11. He mau pahu ti o kekahi kalepa, i hoailonaia, A, E, I, O, He kumu kuai okoa ko kela pahu ko keia pahu. Ina e kawili pu ia i na pouna 7 o ka A, me 5 o ka E, a me 8 o ka I, he $1.21 ke kumu kuai o kekahi pouna. Ina e

kawili pu ia i na pouna 3 o ka A, me 10 o ka I a me 5 o ka O, he $1.50 ke kumu kuai o kekahi pouna. I kekahi la, kuai lilo aku ia i na pouna 8 o ka A, me 10 o ka E, me 10 o ka I, a me 7 o ka O i $48; a kekahi la aku, kuai no ia i na pouna he 18 o ka A, me ka 15 o ka O i na $48. Heaha ke kumu kuai no kekahi pouna o kela pahu a no keia pahu?

12. He 2 mau hakina, a hookahi mahele no laua. Ina e unuhiia ka 1 mailoko mai o ka hoohelu o ka hakina uuku, o ke koena, he $\frac{1}{3}$ ia o ka hakina nui. Ina e unuhiia ka 1 mailoko mai o ka hoohelu o ka hakina nui, e oi palua no ke koena imua o ka hakina uuku. Ina hoi e unuhiia ka hoohelu o ka hakina unku mailoko mai o ka hoohelu o ka hakina nui, he $\frac{1}{3}$ ke kumu o ke koena. Heaha ia mau hakina?

13. He aie ka na kanaka ekolu, o A, E a me I, aole hoi e lawa na dala o kekahi wale no o lakou ke hookaa. I aku la o A ia E, Ina e haawi mai oe ia'u i ka $\frac{1}{2}$ o kou mau dala, e hiki no ia'u ke uku aku. I aku la E ia I, E hiki no ia'u ke uku aku, ke haawi mai oe ia'u i ka $\frac{1}{4}$ o kou mau dala. Aka, lawe no o I i ka $\frac{1}{5}$ o na dala ia A, a hoo! aa aku la i ka aie. He $6\frac{1}{2}$ o ka aie o lakou. Ehia na dala i keia kanaka, i kela kanaka?

PAUKU VIII.

NA HAAWINA E HANAIA'I.

1. Ua kuai lilo aku kekahi, i na pipikane he 16, a me na bipiwahine he 19 i $382; a i kekahi manawa aku kuai no ia i na bipikane he 24, a me na bipiwahine he 17. Ma

ia mau kuai ana, ua like na dala o ka bipikane, a ua like hoi ko ka bipiwahine 1. Heaha ko kekahi bipikane a me ko kekahi bipiwahine?

2. Kuai na kaikamahine elua i mau wahi iwilei lole no laua. I aku o Maria ia Ana, "E haawi mai no'u i 1 iwilei o kou lole, a e like ko kaua mau iwilei." I mai o Ana, "E haawi mai oe ia'u i 1 iwilei o kou lole, alaila e oi palua ko'u mau iwilei imua o kou," Ehia mau iwilei o kela a o keia?

3. Heaha ia mau puuhuahelu, ina he $\frac{1}{3}$ o ka puu mua e hookuiia me na $\frac{5}{8}$ o kela puu, he 66 ka huina, aka, ina e hookuiia $\frac{5}{8}$ o ka mua me ka $\frac{1}{3}$ o ka puu hope, he 60 ka huina?

4. I aku la o A ia B, "I na makahiki he 10 mamua, ua oi palua ko'u imua o kou mau makahiki: a i na makahiki hou aku he 12, e like no ko'u mau makahiki i kou ma ka like o ke 3 me ka 2. Ehia na makahiki o laua i neia manawa?

5. Kamailio pu na kamalii ekolu i ko lakou mau dala, I aku la o A ia E laua o I, "Ina e haawi pakahi mai olua i $5, alaila, e hapalua ko'u mau dala o ko olua koena dala i hui pu ia. Olelo aku la o E ia A laua o I, "Ina e haawi pakahi mai olua i $5, e like auanei ko'u mau dala, me ko olua pu i koe." I mai la o I ia A laua o E, "Ina e haawi pakahi mai olua i $5, e palua auanei ko'u mau dala i ko olua pu i koe." Ehia na dala o kela a me keia o lakou?

6. Ina e hookui aku oe i 2 i ka hoohelu o kekahi hakina, e lilo auanei kona kumu i $\frac{1}{2}$; aka i hookui aku oe i 2 i kona mahele, e like auanei kona kumu me ka $\frac{1}{4}$. Heaha ia hakina?

7. E ulana lole ana na wahine 3; he 63 na iwilei i paa ia lakou i kekahi manawa. Ua oi pa 4 na iwilei o A i ulana ai imua o ka I, a me ka palua hoi imua o ka E: a o ka pa 2 o ka A mau iwilei i hui pu ia me ka pakolu o ka E, ua like ia me ka pa 17 o ka I. Ehia mau iwilei o keia wahine a kela wahine i ulana ai?

8. E imi i na puuhuahelu 3 i lawa ai na $\frac{5}{6}$ o ka mua, me $\frac{3}{5}$ o ka lua, a me $\frac{2}{7}$ o ke kolu i 50; a i lawa hoi $\frac{3}{8}$ o ka mua, a me ka pau o ke koena o ka lua i unuhiia mailoko mai o ke kolu, i 40; a i unuhiia ka 10 mailoko o na $\frac{5}{12}$ o ka huina o na puuhuahelu a pau, he 30 ke koe ia.

9 E hana hoolimalima o A laua o E i na anana papohaku he 220. Ina e hana o A i na la 9, a o E i na la 8, e koe no na anana elua o ka hoopau ana o ka hana: aka, ina e hana o A i na la 8; a o E i na la 9, e hiki no ia laua e hoopau i ka hana, a me na anana keu 4. Ehia mau anana e hana'i ke'la ka maka o laua i ka la hookahi?

10. Hoolimalima ke'ahi i na paahana 3, o A o E a o I, e hana i keia manawa i kela manawa. I kekahi manawa, ua loaa ia A laua o E na $56 i na hebedoma 8; a i kekahi manawa aku, loaa ia A laua o I na $54 i na heb. 9; a i kekahi manawa aku, loaa ia E laua o I na $50 i na heb. he 10. Ehia na dala i ukuia'i keia kanaka kela kanaka no ka hebedoma hana 1?

* 11. Ina e puunaue oe i ka puu nui o na wahi puuhuahelu 2 i ka puu uuku, he 7 ka puuhapa: a o ka huina houluulu o ua mau puuhuahelu la, he 1008 ia. Heaha ia mau puuhuahelu?

12. Manao iho la kekahi mahiai e hoopiha i wahi pahu nui i ke kulina a me ka raiki, i uku no kekahi aie. He 5 mau silina o ka busela kulina, a he 3 silina o ka busela raiki. Ina e hahao ia i na busela raiki 7 a hookaa i ka aie ma ke kulina, aole e piha ka pahu, elua busela e koe i piha ai: aka, ina e hahao ia i na busela kulina 6, alaila hoopiha i ka pahu i ka raiki, e koe no na silina 6 o ka aie i ke kaa ole. Ehia na silina o ka aie? Ehia na busela o ua pahu la e piha ai? Ehia na busela o keia mea kela mea e pono ke hookaa i ka aie?

13. Kuai kahi keiki i kekahi manawa i na ohia 5, me na pea 6, a me na pika 4 i na keneta he 44; a i kekahi la

aku, i 7 pea, 5 pika me 3 alani, i na keneta he 56; a i kekahi la aku, i 8 ohia, 12 pika me 5 alani, na keneta he 89; a i kekahi la aku, i 10 na ohia, 3 pea, a me 9 alani, i na keneta he 74. Ehia na keneta o kekahi hua o keia mea kela mea?

14. I aku la o A ia E lana o I "E haawi mai i ka ½ o ko olua mau puu dala, a he $85 ia'u ilaila." I aku o E ia A laua o I, E hoonui i ½ o ko olua mau puu dala, a he $85 ia'u ilaila." Olelo hoi o I, E haawi mai olua i ¼ o ko olua mau puu dala, a he $85 ia'u ilaila." Ehia na dala o o kela me keia o lakou?

15. Kuai kekahi i pahale nona i na $4350, he $2 ia no ke kapuai hookahi. Ina he 6 mau kapuai hou aku ka laula o ua pahale la, ina ua make na $5394. Ehia na kapuai ka loa a me ka laula o ua pahale la?

16. Eia ma ko'u mau lima he mau puu hua. Ina e hookaa aku au i 10 mai kuu lima hema a ka lima akau, alaila e oi palua na hua o ka akau imua o ko ka hema. Aka, ina e hookaa aku au i 10 mai ka lima akau a ka hema, alaila e oi pakolu na hua o ka hema imua o ko ka akau. Ehia na hua o kela lima keia lima?

17. He mau pina ka na keiki ekolu, o A, o E, a o I. Haawi mua o A ia E a me I i na hua e like ana me ka laua mamua; alaila, haawi o E ia A laua o I i na hua e like ana me ka laua ano; a mahope, haawi aku o I ia A laua o E i na hua e like ana me ko laua ano. Alaila ua pa 16 na hua i kela keiki i keia keiki. Pahia na hua ia lakou i kinohi?

18. He 5 mau kaapuni ana o ka huila mua o kekahi kaa, i na kaapuni ana 4 o ka huila hope. Aka, ina he iwilei 1 hou aku ke anapuni o keia huila kela huila, alaila he 6 ke kaapuni ana o ka huila mua i na kaa ana 5 o ka huila hope, Ehia na kapuai o ke anapuni o kela huila o keia huila?

19. Hele na kanaka 3 ma ka nahelehele e ki manu. A po ka la, akoakoa lakou e mahele like i na manu i loaa, he

96 a pau. Haawi aku o A ia E laua o I i na mea e like ana me na manu i make ia laua: a haawi aku la o E ia A laua o I i na mea e like ana me na manu e paa ana ia laua ilaila: a mahope, haawi aku o I ia A laua o E i na mea e like ana me na mea ia laua; alaila ua like ko laua mau puu manu. Ehia na manu i make i kela kanaka i keia kanaka o lakou?

20. Haawi aku kekahi makua i na puu waiwai kalepa i na keikikane 3 e kalepa ai; a hoi mai lakou, mahele like lakou i ka waiwai i loaa mai. Haawi aku la o A ia E laua o I i na dala e like ana me ka $\frac{1}{3}$ o ka haawina a ka makuakane ia lakou a pau. Pela hoi i haawi aku ai o E ia A laua o I i na dala e like ana me ka $\frac{1}{4}$ o ka waiwai e paa ana ia laua ia manawa. Haawi hoi o I ia laua o E i na dala e like ana me ka $\frac{1}{5}$ o ko laua e paa ana ilaila, alaila he $64 i koe i kela mea i keia mea o lakou. Ehia na dala o ka waiwai a ka makua i haawi ai i kela mea keia mea o lakou?

MOKUNA IX.

No ka Hoailona ana.

Ua ike no kakou mamua aku nei, he mea hiki wawe ka Hoailonahelu ke hoohuli i na kumu o na haawina, a me ka loaa koke i na mea i imiia ma na huahelu. Aka aole oia wale no kona ano, a me ka oihana nui. *E hiki no hoi ia kakou ke unuhi i na kumu hana no loko mai o na mea i hoomaopopoia ma ka hoailona ana.* E hoakakaia keia ano o ka Hoailonahelu ma kekahi mau haawina.

1. E houluulu i ka huina a me ke koena unuhi o na puuhuahelu, 294 a me 175.

Ko laua huina, $294 + 175 = 469$
Ko laua koena unuhi, $294 - 175 = 119$

Eia, 588.

Penei e hoailona ai i keia haawina: o ka a e hoailona i ka puu nui, a o e ka puu uuku. Alaila $a + e$ ko laua huina, a o $a - e$ ko laua koena unuhi; oia ka kakou e houluulu ai.

$$\begin{array}{r} a + e \\ a - e \\ \hline \end{array}$$

Eia, $2a$.

No ka hoike ana i keia hana ana ma ka olelo; *Ina e houluulu kakou i ka huina a me ke koena unuhi o na*

puuhuahelu elua, e like no ka huina me ka palua o ka puu nui.

2. E houluulu i ka huina a me ke koena unuhi o ke 90 a me ke 65, mamuli o keia kumuhana.

3. E houluulu i ka huina a me ke koena unuhi o ka 136 a me ke 97.

4. E houluulu i ka huina a me ke koena unuhi o ke 375 a me ka 129.

5. E unuhi i ke koena unuhi o 278 a me ke 324 mailoko mai o ko laua huina.

Ko laua huina $324 + 278 = 602$
Ka laua koena unuhi $324 - 278 = 46$
Eia, 556.

E hoailona ia mau puuhuahelu e like me mamua, e unuhi kakou i $a - e$ mailoko ae o $a + e$.

$$\begin{array}{r} a + e \\ a - e \\ \hline 2\,e. \end{array}$$

Oia keia, *Ina e unuhi kakou i ke koena unuhi o na puuhuahelu 2 mailoko ae o ko laua huina, e like no ke koena me ka pa 2 o ka puu uuku.*

6. Mailoko mai o ka huina o 77 a me 25, e lawe i ko laua koena unuhi.

7. Mailoko mai o ka huina o 139 a me 62, e lawe i ko laua koena unuhi.

8. Mailoko mai o ka huina o 827 a me 364, e lawe i ko laua koena unuhi.

9. E hoonui i ka huina o 139 me 87, me ko laua huina unuhi.

Ko laua huina, $139 + 87 = 226$

Ko laua koena unuhi, 139 — 89 = 52

452

1130

Ko laua huina hoonui, 11752

Ina e hoailona kakou ia mau puuhuahelu e like me mamua alaila o $a + e$ ko laua huina houluulu, a o $a - e$ ko laua koena unuhi; a e hoonui i kekahi me kekahi, penei;

$$\begin{array}{r} a + e \\ a - e \\ \hline a^2 + a\,e \\ -a\,e - e^2 \\ \hline \end{array}$$

Ko laua huina hoonui, $a^2 \quad * \quad - e^2$

Oia keia ma ka olelo: *Ina e hoonuiia ka huina o na puuhuahelu elua me ke koena unuhi o laua, e like no ka huina hoonui me ke koena unuhi o ko laua papa* 2.

10. E hoonui i 9 + 7 me ka 9 — 7 ma ia kumu hana.

11. E hoonui i 12 + 8 me ka 12 — 8.

12. E hoonui i ka 24 + 15 me ka 24 — 15.

13. Ua haawiia 9310 a me 9298: a heaha ke koena unuhi o ka papa 2 o laua?

Eia ka hiki wawe o ka loaa ana o ke kumu o ia haawina: *Ina e hoonuiia ka huina o na puuhuahelu me ke koena unuhi o laua, e lilo no ka huina hoonui i koena unuhi o ka papa* 2 *o laua.*

Penei e hanaia'i ka haawina 13:

9310

9298

18608, ka huina o na puuhuahelu.

9310 — 9298 = 12. ke koena unuhi o laua.

223296, ke koena unuhi o ka papa 2 o laua.

Pono e hoomanao i keia kumuhana, i mea e hoopokole ai i na hana, ke nui na puuhuahelu o ka haawina.

14. Ua haawiia 23136 a me 21947; a heaha ke koena unuhi o ka papa 2 o laua?

15. Ua haawiia 15925 a me 14987; a heaha ke koena unuhi o ka papa 2 o laua?

16. Ua haawiia 987264 a me 978351: a heaha ke koena unuhi o ka papa 2 o laua?

17. Ua haawiia 999999 a me 999993; a heaha ke koena unuhi o ka papa 2 o laua?

18. Heaha ka papa 2 o ka 28? Eia, 784.

He $a = 20$, a o ka $e = 8$; alaila $a + e = 28$.

$$\begin{array}{r} a + e \\ a + e \\ \hline a^2 + a\,e \\ + a\,e + e^2 \\ \hline a^2 + 2\,a\,e + e^2. \end{array}$$

Ma keia hana ana, ua akaka, *He like no ka papa 2 o ka huina o na puuhuahelu elua me ka huina o ko laua mau papa 2 i hoomahuahuaia e ka palua o ko laua huina hoonui.*

19. Heaha ka papa 2 o $a - e$?

$$\begin{array}{r} a - e \\ a - e \\ \hline a^2 - a\,e \\ - a\,e + e^2 \\ \hline a^2 - 2\,a\,e + e^2 \end{array}$$

Oia hoi keia, *O ka papa 2 o ke koena unuhi o na puuhuahelu elua, ua like ia me ka huina o laua mau papa 2 i hoemiia e ka palua o ko laua huina hoonui.*

20. Kuai na kanaka 2 i mau hale no laua, i $573; a

he 57 na dala ka oi o ke kumu kuai o ko E hale imua o ko A. Heaha ke kumu kuai o kela hale keia hale?

He w = ke kumukuai o ko A hale.
Alaila, $w + 57$ = ke kumukuai o ko E.
A, $w + w + 75 = 573$.
oia $2w + 57 = 573$;
$2w = 573 - 57 = 516$.
$w = 258$, ke kumukuai o ko A hale.
$w + 57 = 315$, ke kumukuai o ko E hale.

Ma keia haawina, e puuuaueia'na ka 573 i na puuhuahelu 2, i oi aku ka puu nui he 57 imua o kela puu; oia hoi, *A haawiia ka huina a me ke koena unuhi o na puuhuahelu elua, malaila e imi ai kakou i ua mau puuhuahelu la.*

E hoailona i ka huina o na puuhuahelu ma ka a, a i ke koena unuhi o laua ma ka e; a he w ka hoailona o ka puu uuku; alaila, he $w + e$ = ka puu nui.

Nolaila, $w + w + e = a$
oia $2w + e = a$
$2w = a - e$
$w = \frac{a-e}{2}$, ka puu uuku.

Penei e hoikeia'i keia hana; *Ina mailoko mai o ka huina o na puuhuahelu elua e nuhi kakou i ko laua koena unuhi, e like no ka hapalua o ke koena me ka puuhuahelu uuku.*

Eia hou, $w = \frac{a-e}{2}$, mai luna mai.

Nolaila, $w + e = \frac{a-e}{2} + e$, ma ka hookui ana i ka e ma na aoao elua.

oia hoi, $w + e = \frac{a-e}{2} + \frac{2e}{2} = \frac{a-e+2e}{2}$

$w + e = \frac{a+e}{2}$, ka puu nui.

Penei keia hana: *Ina e hookui kakou i ke koena*

nnuhi o na puuhuahelu elua me ka huina o laua, e like no ka ½ o ka huina hou me ka puu nui.

21. O ka huina o na puuhuahelu elua, he 175 ia, a he 81 ko laua koena unuhi. Heaha ia mau puuhuahelu?

Maanei he $a = 175$, a he $e = 81$

$$\frac{a-e}{2} = \frac{175-81}{2} = \frac{94}{2} = 47, \text{ ka puu uuku.}$$

$$\frac{a+e}{2} = \frac{175+81}{2} = \frac{256}{2} = 128, \text{ ka puu nui.}$$

22. Ua loaa i na kanaka elua, o A laua o E, na $3529; a ua oi aku ko A puu dala he 721 imua o ko E. Ehia na dala i keia kanaka kela kanaka?

23. Uku aku la kekahi i $387 no ka lio a me ke kaa; he oi na dala o ke kaa he 75 imua o ko ka lio. Ehia na dala o ke kumukuai o keia mea a o kela mea?

24. Kauoha kekahi kanaka make i $9134, e puunaueia'i no kana wahine a me ke keiki penei, e oi ko ka wahine puu he $1486 imua o kela puu. Ehia na dala o keia puu a o kela puu?

25. Maloko o ka aina o E he 12 mau akere oi imua o ko B: a maloko o na aina a elua he 162 mau akere. Ehia na akere ia A? ehia hoi ia B?

26. I aku o A ia B, "E haawi mai oe i $16, a e like ko'u puu dala me kou; no ka mea, ia kaua pu he $130." Ehia na dala ia A? Ehia hoi ia B?

27. Maloko o kekahi pahu wai, he 2 mau puka kahe; a ma ia mau puka e kahe ana na gal. wai 203 i ka hora 1. Aka, ma kekahi puka he 13 mau gal. oi o ke kahe ana imua o ko kela puka. Ehia mau galani kahe ma keia puka ma kela puka?

28. Ehia mau pouna ti he 5 silina o ka pouna 1, e pono ke kuaiia'ku, a make mai na gal. waina he 75, ma na silina 8 o ke gala. 1?

Ha $w =$ na pouna ti.

Alaila $5\,w = 75 \times 8 = 600$

$w = 120$, na pouna ti e make.

Ma ka hoailona ana: Ehia na pouna ti, he a silina o ka pouna 1, e make i na b galani waina, ma na e silina o ke galani 1?

He $w =$ na pouna ti.

Alaila $a\,w = b\,e$.

$$w = \frac{b\,e}{a}.$$

Ma ka hoike i keia kumuhana i na huaolelo: *E hoonui i ke kumu o ka haawina me ke kumukuai o ia mea, a e puunaueia ka huina hoonui e ke kumukuai o ka mea i imiia.*

29. Ehia na gal. aila, 4 silina o ke gal. 1, e make i na barela palaoa he 58, he $5 ke kumukuai o ka barela 1?

30. Ehia na pouna ko, he 25 na keneta o ka pouna 1, e make i na iwilei lole he 625, he 13 na keneta o ka iwilei 1?

31. Kuai lilo aku kekahi i na akere aina he 17, he $30 no ka akere 1; a ua ukuia mai ia ma ka palaoa, he $5 no ka busela 1. Ehia na busela palaoa e ukuia mai?

32. Ehia na gal. waina, he $1.75 o ke gal. 1, e make i na pouna kepau he 1295, he 5 na keneta o ka pouna 1?

33. E mahele i $750 no A laua o B, i oi pa 4 ko B puu imua o ko A. Ehia na dala o keia puu a o kela puu?

He $w =$ ka puu no A.

A he $4\,w =$ ka puu no B.

Alaila, $w + 4\,w = 750$,

oia $5\,w = 750$,

$w = 150$, ka puu no A.

$4\,w = 600$, ka puu no B,

Ma keia haawina e puunaueia'i ka puuhuahelu i ikea ma na puu like ole elua. Peni ia e hoailonaia'i.

E hoailona i ka puu o ka haawina ma ka a.

A he $w =$ ka puu no A,

A he $4\,w =$ ka puu no B.

Alaila, $w + 4w = a$
oia, $5w = a$

A he $w = \frac{a}{5}$, ka puu no A.
$4w = \frac{4a}{5}$, ka puu no B,

Ina hoi ma kekahi puu dala e ae i hoailonaia ma ka a, ua maopopo he $\frac{1}{5}$ o ia puu ka mea e lilo ana ia A; a he $\frac{4}{5}$ ka mea e lilo ana ia B.

Ina paha o ka a, oia ka puu okoa, = $1000, alaila he $\frac{1}{5}$ o ka $a = 200$, a, $\frac{4}{5}$ o ka $a = 800$,

Ina o ka a ka hoailona no $1500, $\frac{a}{5} = 300$, a $\frac{4a}{5} = 1200$.

He pono paha ke hoailona hou aku i keia haawina, penei;

E puunaue i na a dala i na puu like ole elua, no A he w puu, a no B, he $b\,w$ puu. Ehia na dala o kela mea keia mea o laua?

He w = na dala o ko A puu.
Alaila he $b\,w$ = na dala o ko B puu.
A he $w + b\,w = a$,
oia hoi, $(1 + b)\,w = a$,
$w = \frac{a}{1+b}$, ko A puu.
a $b\,w = \frac{a}{1+b} \times b = \frac{a\,b}{1+b}$, ko B puu.

Ma ka hoohalike $w + b\,w = a$, o ka aoao mua, o $w + b\,w$, he like ia me ka $(1 + b)\,w$; nolaila, o ka $(1 + b)$ ka heluna o ka w.

34. Ma keia kumuhana, e puunaue i $1200 no na kanaka 2, i oi palima ko kekahi puu imua o ko kela.

Maanei, o ka $a = 1200$, o ka $b = 5$
Nolaila, $\frac{a}{1+b} = \frac{1200}{1+b} = \frac{1200}{6} = 200$ ka puu uuku.
A, $\frac{a\,b}{1+b} = \frac{6000}{1+b} = \frac{6000}{6} = 1000$, ka puu nui.

35. I aku la kekahi makuakane i kana keiki, "Ua pa 4 ko'u mau makahiki, a o ka huina o ko kaua mau makahiki a pau, he 85 ia." Ehia na makahiki o kela a me keia?

36. E puunaue i $2592 i na puu 2 i oi pahiku kekahi imua o kela puu.

37. I aku la o A ia E, "O ke kumukuai i ko kaua mau aina, ke huipuia, he $36465; aka, o kou aina he $\frac{1}{4}$ wale no ia o kou." Ehia na dala e kuai ai i kela aina i keia aina;

38. Kuai aku la kekahi kalepa i na wahi apa lole paina i $5000, he omaomao kekahi, he eleele kekahi, a he ulaula kekahi; he 10 ke kumukuai i ka iwilei omaomao, he $11 no ka iwilei eleele, a he $7 no ka iwilei ulaula. Ua oi palua na iwilei o ka omaomao imua o ka eleele; a ua like na iwilei ulaula me na iwilei o ka omaomao a me ka eleele. Ehia na iwilei o kela ano keia ano?

He w = na iwilei eleele,

$2w$ = na iwilei omaomao,

$3w$ = na iwilei ulaula,

Alaila, $10w + 22w + 21w = 5000$, ma ka haawina.

oia $53w = 5000$,

$w = \frac{5000}{53}$, $= 94\frac{18}{53}$, na iwilei eleele

$2w = 188\frac{36}{53}$, na iwilei omaomao.

$3w = 283\frac{1}{53}$, na iwilei ulaula.

Iloko o kela mau iwilei a pau, ua loaa na hakina. Ke makemake nei au e imi i kekahi puuhuahelu e pono ke panai ma kahi o ka $5000, i loaa'i na huahelu okoa wale no iloko o na iwilei. Nolaila, he pono no e hana i keia haawina ma ka hoailona ana i ka puuokoa ma ka a.

Ina e hoailonaia na iwilei eleele i ka w, na iwilei omaomao i ka $2w$, a me na iwilei ulaula i ke $3w$, e like mamua, alaila ua loaa keia hoohalike:

$$10\,w + 22\,w + 21\,w = a,$$
$$53\,w = a,$$
$$w = \tfrac{a}{53}.$$

O kekahi puuhuahelu a hiki ke puunaueia e ke 53 a koe ole kekahi hakina, oia hoi ka huina hoonui o kekahi puuhuahelu i hoonuiia me ke 53, e hiki ke kau ia mea ma kahi o ka a, a e kaawale na hakina ma ke kumu loaa.

Ina paha, he 2491 ke kumukuai o ka lole a pau; (oia ka mea i loaa ma ka hoonui ana i ke 53 me 47;) alaila, he 47 na iwilei eleele kana i kuai ai, a he 94 na iwilei omaomao, a he 141 o ka ulaula.

39. Iloko o kekahi kula, e ao ana ka $\frac{1}{4}$ o na haumana i ka olelo honua, he $\frac{1}{5}$ i ka anahonua, a he $\frac{1}{6}$ i ka hoailona helu, a o ka poe i koe he a, e ao ana i ka helunaau. Ehia na haumana iloko o ia kula?

He m = ka puu haumana a pau.

Alaila, $m = \frac{m}{4} + \frac{m}{5} + \frac{m}{6} + a,$

oia hoi, $60\,m = 15\,m + 12\,m + 10\,m + 60\,a;$

$60\,m = 37\,m + 60\,a$, ma ka hookui ana;

$23\,m = 60\,a$, ma ka hookaa ana?

$$m = \tfrac{60\,a}{23},$$

Ina e kauia ma kahi o ka a, kekahi e hiki ke puunaueia a koe ole ka hakina, alaila e loaa auanei ka puuhuahelu okoa no na haumana.

E panai paha i 46 ma kahi o ka a. Alaila,

Eia na haumana: 120.

He mau mea hoikeike keia mau haawina hope elua, i ke ano o ka hoomakaukau i na kumuhana, i kaawale ai na mea i loaa i na hakina.

40. He mau hoakuai o A, o E, a o I; a ua waiwai lakou ma ke kuai ana he $1350. I ka hoiliili ana i ko lakou

kumukuai, kokua aku la o A i $7 i ko E kokua ana i $6. A kokua aku la o E $6 i ko I kokua ana i $5. Pehea la e puunaueia'i ka mea i loaa, i like ia me na dala a kela mea a keia mea i kokua ai?

He w = ka puu no A.

Alaila $\frac{6w}{7}$ = ka puu no E

a, $\frac{5w}{7}$ = ka puu no I.

Nolaila, $w + \frac{6w}{7} + \frac{5m}{7} = 1350$, ma ka haawina.

oia, $7w + 6w + 5w = 9450$, ma ka hoonui ana.

$18w = 9450$, ma ka houluulu.

$w = 525$, ko A puu.

Nolaila, $\frac{6w}{7} = 450$, ko E puu.

$\frac{5w}{7} = 375$, ko I puu.

Ina e hoailona kakou i keia haawina; peneiia: kokua o A i na a dala, i ko E kokua ana i na e dala; a kokua o E i na e dala i ko I kokua ana i na i dala, oia hoi keia; e panai kakou i na hua a, e, i, ma kahi o na huahelu 7, 6, 5. A e hoailona kakou i ka puu dala okoa i ka h.

He w = ka puu loaa ia A.

Alaila, $\frac{ew}{a}$ = ka puu no E.

A he $\frac{iw}{a}$ = ka puu no I.

Nolaila, $w + \frac{ew}{a} + \frac{iw}{a} = h$, ma ka haawina.

$aw + ew + iw = ah$, ma ka hoonui ana.

oia $(a + e + i)\, w = a\, h$,

$w = \frac{a\, h}{a+e+i}$, ka puu no A.

$\frac{ew}{a}$ oia $\frac{e}{a}\, w = \frac{e\, h}{a+e+i}$, ka puu no E.

$\frac{iw}{a}$ oia $\frac{i}{a}\, w = \frac{i\, h}{a+e+i}$, ka puu no I.

Oia keia ma ka olelo. *I mea e loaa ko keia puu ko kela puu o ka waiwai i loaa, e hoonui i ka puu okoa i loaa mai me kana mea i kokua ai, a e puunaue i ka huina hoonui ma ke kumukuai okoa.*

Ina he waiwai *poho* e puunaueia'i mawaena o na hoakuai, e like me kela hana ana maluna e ikeia'i ka puu poho o kela kanaka o keia kanaka. He kumu hana keia no ka ike i na puu waiwai o na hoakuai, ke like ka manawa o ke kuai ana.

41. E puunaue i $8736 no na kanaka ekolu, i like ai na puu me ka like ana o ke 3, ka 4 a me ka 5, kekahi me kekahi.

42. Ua waiwai ka hoakuai elua, o A laua o E, he $3792 i ka pau ana o ka makahiki kuai. Ua kokua o A i $5000, a o E i $7000 ilaila, i kumukuai no laua. Heaha ka puu dala no kela a me keia, o ka waiwai i loaa?

43. Hooili pu na hoakuai ekolu i na waiwai kuai ma ka moku kalepa. Kokua aku la o A i $300 o ke kumukuai i ko E kokua ana i $500, a me ko I kokua ana i $700. Poho iho la ma ia kuai ana he $2595. Pehea la e puunaue'a'i keia poho ana ia lakou, e like me ko lakou waiwai kokua?

44. E puunaue i $513 no A, E, a me I; ma ka like ana o ke 3, ka 7, a me ka 9, kekahi me kekahi.

45. He mau hoakuai, o A, o E, a o I; a i ke kuai ana, ua waiwai lakou i na $8840. Kokua lakou i na dala o ke kumukuai ma ka like ana o ka 5, ke 6 a me ka 7. He 4 mau malama kuai me na dala o A, he 3 malama kuai me ko E, a he mal. ko I: pehea la e puunaueia'i ka waiwai loaa, i like ai ia me ke kokua ana?

He w = ka puu kokua o A.

Alaila, $\frac{6w}{5}$ = ka puu a E i kokua ai.

a he $\frac{7w}{5}$ = ka puu a I.

No ka mea, kokua no o A i na w dala i na mal. 4, ua like no ia me 4 w i ka malama 1; a o ko E $\frac{6w}{5}$ dala i na mal. 3, he $\frac{18w}{5}$ i ka mal. 1; a o I, $\frac{7w}{5}$ dala i na malama 2 = $\frac{14w}{5}$ no ka malama 1.

Nolaila, 4 w = na dala loaa ia A.

$\frac{18w}{5}$ = na dala loaa ia E.

$\frac{14w}{5}$ = na dala loaa ia I.

Alaila, 4 $w + \frac{18w}{5} + \frac{14w}{5} = 8840$, ma ka haawina.

$20w + 18w + 14w = 44200$,

oia, $52w = 44200$,

$w = 850$.

Alaila, 4 $w = 3400$, ko A puu i loaa.

$\frac{18w}{5} = 3060$, ko E puu i loaa.

$\frac{14w}{5} = 2380$, ko I puu i loaa.

Ina paha e hoailonaia ka puu dala i loaa i ka p; a kokua o A i na a dala; a o E i na e dala, a o I i na i dala; a he h na malama o ke kuai ana me ko A waiwai, a he m malama o ko E, a he n malama o ko I.

He w = ka waiwai kokua a A.

$\frac{ew}{a}$ ka waiwai kokua a E.

$\frac{iw}{5}$ = ka waiwai kokua a I.

Ina e hoonui i na waiwai kokua a kela mea a keia mea me na manawa o ke kuai ana.

Alaila, hw = ko A puu waiwai loaa,

$\frac{emw}{a}$ = ko E puu waiwai loaa,

$\frac{inw}{a}$ = ko I puu waiwai loaa.

Alaila, $h\,w + \frac{e\,m\,w}{a} + \frac{i\,n\,w}{a} = p$, ma ka haawina.

$a\,h\,w + e\,m\,w + i\,n\,w = a\,p$ ma ka hoonui ana.

oia hoi, $(a\,h + e\,m + i\,n)\,w = a\,p$,

$$w = \frac{a\,p}{a\,h + e\,m + i\,n}.$$

Nolaila, $h\,w = \frac{a\,h\,p}{a\,h + e\,m + i\,n}$, ko A puu waiwai.

$\frac{e\,m\,w}{a} = \frac{e\,m\,p}{a\,h + e\,m + i\,n}$, ko E puu waiwai.

$\frac{i\,n\,w}{a} = \frac{i\,n\,p}{a\,h + e\,m + i\,n}$, ko I puu waiwai.

Aia loa ke kumu o ka w, e ikeia auanei ka hana ana e maopopo ai na puu o A, o E, a o I, ma ka panai ana. No ka mea, o ko A puu waiwai loaa, he $h\,w$ ia, ke hoonui nei kakou i ke kumu o ka w me ka h, a ua loaa $\frac{a\,h\,p}{a\,h + e\,m + i\,n}$, a pela aku no ma na mea i koe.

Nolaila, i mea e loaa'i ka puu o kekahi hoakuai, *E hoonui i ka puuokoa me ka huina hoonui o kona waiwai kokua me ka manawa o ke kuai ana, i mea mahele. Alaila, e hoonui i kela waiwai kokua i keia waiwai kokua me ka mauawa o ke kuai ana, a e puunaue i ka puu okoa me ka huina houluulu o keia mau hoonui ana.*

46. He mau hoakuai o A, o E, a o I; a he $2160 ka waiwai loaa. Kokua o A i $400 no na malama 5; o E i $500 no na malama 2; a o I i $600 no na malama 4. Heaha ka puu dala o ka waiwai i loaa no keia kanaka, no kela kanaka?

47. Kokua pu na kanaka ekolu, o A, o E, a o I, e hoolimalima i ka hanai lio no $82. He 3 mau lio ka A i hanai ai ilaila i na malama 4: he 4 lio ko E, i na mala. 2; he 7 ka I i na mala. 3. Pehea ka uku pono o kela kanaka o keia kanaka?

48. Elua mau hoakuai o A, laua o E; a loaa mai $2100. He $1400 ke kumu kuai o laua; na A i kokua $5000; na E hoi $9000. He makahiki okoa o ko A kuai

ana; aka he 5 mau malama o ko E. Heaha ka puu dala o ka waiwai loaa no kela mea no keia mea?

49. I manao kekahi e hui pu i ke kulina, he a mau silina o ka busela 1, me ka bale, he e mau silina o ka busela 1, i make ai ka busela o ka huina i na i silina. Ehia na busela o kela mea keia mea e pono ke huipu ia, i loaa'i ka huina, he n na busela?

He $w =$ na busela kulina.

He $n - w =$ na busela bale.

A he $aw =$ ke kumukuai o ke kulina,

$en - ew =$ ke kumukuai o ka bale,

a, he $in =$ ke kumukuai o ka huina.

Alaila $aw + en - ew = in$, ma ka haawina.

$aw - ew = in - en$, ma ka hookaa ana.

oia hoi $(a - e)w = in - en$,

$w = \frac{in-en}{a-e}$, na busela kulina.

$n - w = n - \frac{in-en}{a-e}$, oia hoi $\frac{an-in}{a-e}$ na busela bale.

50. Manao iho la kekahi kalepa, e hui pu i ke ko, o na peni he 10 no ka pouna 1, me ke ko o na peni 7 no ka pouna, i loaa'i ka 100 weta e pono ke kuaiia ma na peni 8 no ka pouna 1. Ehia na pouna ko o kela ano o keia ano e pono ke huiia?

51. E manao ana kekahi kalepa e pai pu i na galani aila kukui, he mau mea kumukuai o koa, he dala ke kuai i ke galani o kekahi aila, a he mau silina 3 no ke gal. o kekahi. Ehia na galani o kela aila, o keia aila, i lawa ai na gal. he 36, ma na silina 4 no ke gal. 1?

52. He 2 mau kanaka hele, mai kahi hookahi ka hele ana, a ma ke alanui hookahi no hoi; aka, hele e o A i a mau hora mamua o E; hele hoi oia i n mau mile i ka hora 1. Hahai aku o E i m mau mile i ka hora 1. Ina e oi aku na mile o ka m imua o ka n, alaila ehia mau hora e hele ai o E a loaa aku o A? Ehia hoi na mile e hele ai oia?

He w = na hora i hele ai o E.
Alaila, $w + d$ = na hora i hele ai o A.
A $m w$ = na mile i hele ai o E.
$n w + n a$ = na mile i hele ai o A.
Nolaila $m w = n w + n a$,
oia, $m w - n w = n a$,

$$w = \frac{n a}{m - n}, \text{ na hora hele o E.}$$

$$w + a = \frac{n a}{m - n} + a; \text{ oia } \frac{m a}{m - n}, \text{ na hora hele o A.}$$

$$m w = \frac{n a}{m - n} \times m, \text{ oia } \frac{m n a}{m - n} \text{ na mile i hele ai.}$$

53. Ina e hele aku o A i na hora he 10 mamua o E, a hele no ia i 3 mau mile i ka hora 1, a hele hoi o E i na mile 4 i ka hora 1 mahope o A, ehia mau hora a me na mile o ka hele ana, a pili pu laua?

54. Ina e hele o A i na hora 6 mamua o E, e hele ana i na mile 3 i ka hora 1, a hele hoi o E mahope o A i na mile 5 i ka hora 1, ehia na hora a me na mile a laua e hele ai a pili?

55. E oki i kekahi kaula k i na apana 2, i like ai ka loa o kekahi me ko kekahi, ma ka like ana o ka m me ka n.

He w = kekahi apana.

$$\frac{m w}{n} = \text{kela apana.}$$

Nolaila $w + \frac{m w}{n} = k$, ma ka haawina.
oia $n w + m w = k n$,

$$w = \frac{k n}{n + m}, \text{ ka loa o kekahi apana.}$$

$$\frac{m w}{n} = \frac{k m}{n + w}, \text{ ka loa o kela apana.}$$

56. Ina he 20 na kapuai o ke kaula, a e like kekahi apana me kekahi ma ka like ana o ke 3 me ka 4; ehia na kapuai o kela apana o keia apana?

57. E oki i kekahi kaula he 36 iniha o kona loa, i like ai kekahi apana me kekahi ma ka like ana o ka 4 me ka 5.

58. E puunaue i kekahi puuhuahelu, a, i na puu elua, i like ai ko laua huina hoonui me ka papa 2 o ka puu nui, me ka like ana o ka m me ka n.

He w = ka puu nui,
Alaila $a - w$ = ka puu uuku.
A, $a\,w - w^2$ = ko laua huina hoonui.
a, w^2 = ka papa 2 o ko puu nui.
Nolaila, $w^2 = \frac{a\,n\,w - n\,w^2}{m}$,
oia, $m\,w^2 = a\,n\,w - n\,w^2$
a $m\,w = a\,n - u\,w$, ka puunaue ana me ka w.
$m\,w + n\,w = a\,n$,
$w = \frac{a\,n}{m+n}$, ka puu nui.
$a - w = a - \frac{a\,n}{m+n}$, oia $\frac{a\,m}{m+n}$, ka puu uuku.

59. I 100, ka puuhuahelu e puunaueia'i ma keia kumu hana, a e like na puu ma ka like o ka 2 me ke 3.

60. E puunaue i 100 i na puu elua. i like ai ko laua huina hoonui me ka $\frac{1}{3}$ o ka papa 2 o ka puu nui.

61. Heaha kela puuhuahelu, ina e hookui aku i ka a me ia, a e unuhi i ka e mailoko ae o ka huina, a e hoonui i ke koena me ka i, alaila e puunaue me ka h, e like no ka puuhapa me ua puuhuahelu la?

Eia, $\frac{a\,i - e\,i}{h-i}$.

62. Heaha ka puuhuahelu, ina e hookui aku i ke 40, me ia, a e unuhi i 25 mailoko ae o ka huina, e hoonui i ke koena me ke 6, alaila e puunaue me ka 9, a e like no ka puuhapa me ua puuhuahelu la?

63. Heaha ka puuhuahelu, ina e hookui aku oe i 84 me ia, a e unuhi i 38 no loko mai o ka huina, a e hoonui i ke koena me ka 5, a e puunaue i ka huina hoonui me ka 7, e like no ka puuhapa me ua puuhuahelu la?

64. Ua loaa i kekahi kanaka kuai he $4051 ma ke kuai ana, a ua poho hoi $3186 i na mea aie wale. A pau ke kuai ana, ike iho la ia, o na $\frac{5}{6}$ o kona waiwai i koe, ua like ia me kona waiwai i ka wa ana i hoomaka ai i ke kuai. Ehia na dala o kona waiwai i kinohi?

65. Uku aku la kekahi i na a kanaka, me na e keiki i na m dala no ka la hana hookahi: a mahope aku, uku aku la ia i na o kanaka me na i keiki i n mau dala no ka la hana 1. Heaha kana mea i uku ai i kekahi i kekahi?

He p = ka uku no kekahi kanaka,
a he w = ka uku no kahi keiki.
A. Alaila a $p + ew = m$
E. a $ip + ow = n$

E hoonui i ka hoohalike A me ka i, a i ka hoohalike E me ka a, i like ai na heluna o ka w; penei,

I. $aip + eiw = im$
O. $aip + aow = an$

* $eiw - aow = im - an$, ma ka unuhi ana.
oia, $(ei - ao)w = im - an$,
$w = \frac{im-an}{ei-ao}$, ka uku no ke keiki.

Ma ka panai ana i keia kumu o ka w ma ka hoohalike A, ua loaa

$p = \frac{en-om}{ei-ao}$, ka uku no ke kanaka.

66. Uku aku la kekahi i na kanaka 5 a me na keiki 8 i $9 no ka la hana 1: a mahope aku, uku aku la ia i na kanaka 7 a me na keiki 6 i $10 no ka la hana 1. Heaha kana mea i uku ai i kekahi i kekahi?

67. Hoolimalima kekahi i ka puu dala, no 6 ke hapa 100 kuala o ka makahiki hookahi. A hala na makahiki 4, ua ukuia mai oia $775 no ka puu hoolimalima a me ke kuala. Heaha ke kumu hoolimalima, a me ke kuala?

He w = ka puu aie.

Alaila, no ka mea, he 6 hapa 100 ke kuala, o na $6 ia i ukuia na ka aie ana i na $100, oia $\frac{6}{100}$ o ka puu aie i uku hoopanee aku no ka makahiki hookahi.

$\frac{6w}{100}$ = ke kuala no ka mak. 1.

$\frac{24w}{100}$ = ke kuala no na mak. 4

Nolaila, $w + \frac{24w}{100} = 775$, ka puu aie a me kuala.

$100w + 24w = 77500$, ma ka hoonui ana.

oia $124w = 77500$,

$w = 625$, ka puu aie.

68. No ka hoailona ana i keia haawina, ua haawiia mai ka puu aie ka hapa 100, a me ka manawa, i kumu e loaa'i ka puu aie.

He mea pono ma keia hana ana e hoailona i na hua olelo ma ka huamua iloko olaila, i mea e maopopo ai ka hana ana: penei,

p = ka puu aie.

h = ka hapa haneri.

m = ka manawa.

k = ke kuala.

u = ka uku, a pau loa; ua like ia me $p + k$.

Ma ka haawina maluna, e imi i ke kumu o ka p.

hp = ke kuala no ka makahiki 1.

mhp = ke kuala no na makahiki he m.

$p + mhp$ = ka uku,

Nolaila, $p + mh + p = u$,

oia hoi, $(1 + mh)p = u$,

a $p = \frac{u}{1 + mh}$.

Eia hoi ke kumu hana: *E hookui i ka* 1 *me ka huina hoonui o ka manawa a me ka hapa* 100, *a e puunaue i ka uku me ka huina.* A o ka puuhapa, oia ka puu aie.

He kumu hana ia e imi ai i ka uku hooemi. Ina e uku aku kekahi i kana aie mamua o ka manawa i oleloia no ka hookaa ana, he mea pono ke hooemi iho i ka uku o ua aie la. He pono no e uku aku ia i ka puu dala e hiki ai me kona uku kuala o ia manawa i hookuiia me ia ke hookaa i ua aie la. Ina he aie ko'u i $100 i oleloia e uku mahope o ka makahiki, a manao iho paha wau e uku koke ano, e pono no ke hooemiia ua 100 dala la ma na dala e like ana me ke kuala o ka puu dala i hui pu ia me kona kumu aie, a like ka huina me na $100.

69. Ina he aie ko'u i $392, a ma ka olelo e ukuia oia mahope o na makahiki 2, ehia na dala e pono ke uku aku ano, ma ke 6 hapa 100 ka uku hoemi?

Maanei e imi i ka puu dala e lilo ana me kona kuala i hui pu ia me ia i $392, mahope o na makahiki 2?

70. Hoolimalima kekahi i kekahi puu dala no na makahiki 3 ma ka 5 hapa 100 o ke kuala: a hala ia manawa ua ukuia mai no na dala he 8234, ilaila ka puu aie a me ke kuala. Ehia na dala o ka puu aie?

71. Kuai lilo aku kekahi kalepa i na waiwai he $1961 e ukuia mai ai mahope o kekahi makahiki. Ehia na dala e pono ke hoemi o ia uku, ke uku koke ia oia ia manawa, ma ke 6 hapa 100 o ka hoemi ana?

72. Heaha ka hoemi ana o na dala he 713 no na makahiki 4, ma ke hapa 100 no ka makahiki 1?

73. A i hui pu ia ke kuala o kekahi puu dala me ia, ma ka 5 hapa 100 no ka mak. 1, e lilo no ka huina i $667 mahope o na makahiki 3. Heaha ia puu dala?

74. Ua haawiia ka uku, ka manawa, a me ka puu aie, a malaila e imi ai i ka hapa 100.

$h\,p =$ ke kuala no ka mak. 1.
$m\,h\,p =$ ke kuala no na m makahiki.
$p + m\,h\,p =$ ka uku,
Alaila, $p + m\,h\,p = u$,
$m\,h\,p = u - p$
$h = \frac{u-p}{m\,p}$.

Oia hoi keia, *Noloko mai o ka uku e unuhi i ka puu aie, a e puunaue i ke koena i huina hoonui o ka puu aie me ka manawa. O ka puu hapa ka hapa* 100.

75. Hoolimalima kekahi i $420; a hala na mak. 5 ua ukuia mai nona na $546. Heaha ka hapa 100 kuala o ia puu aie no ka mak. 1?

76. Heaha ka hapa 100 kuala o ka puu aie he $380 ke ukuia na $513 mahope o na mak. 7?

77. Ua haawiia ke kuala, ka manawa a me ka hapa 100, a malaila e imi ai i ka puu aie.

$h\,p =$ ke kuala no ka mak. 1.
$m\,h\,p =$ ke kuala no na mak. he m.
Nolaila, $m\,h\,p =$ k,
$p = \frac{k}{m\,h}$.

Oia hoi keia, *E hoonui i ka manawa me ka hapa* 100, *a e puunaue i ke kuala i ka huina hoonui. O ka puu-hapa ka puu aie.*

78. Uku aku la o E i $126 no kekahi puu dala aie i na makahiki 3, ma ka 5 hapa 100 ke kuala. Heaha ka puu aie?

79. He $288 ke kuala a kekahi i uku aku ai na kana aie i kekahi puu dala i na makahiki 4, ma ke 6 hapa 100 ke kuala. Heaha ka puu aie?

80. Ua haawiia ka uku, ka puu aie a me ka hapa 100, a malaila e imi ai i ka manawa.

$h\,p =$ ke kuala no ka mak. 1.
$m\,h\,p$ ke kuala no na mak. he m.
$p + m\,h\,p =$ ka uku.
Nolaila, $p + m\,h\,p = u$.
oia $m\,h\,p = u - p$,
$m = \frac{u-p}{h\,p}$.

Oia hoi keia, *Mailoko mai o ka uku e unuhi i ka puu aie, a e puunane i ke koena i ka huina hoonui o ka hapa haneri me ka puu aie. O ka puu hapa ka manawa.*

81. Aie no kekahi i $460, ma ka 5 hapa 100 ke kuala no ka mak. 1 : a i ka manawa e uku ai, uku aku la ia i $529 no ka puu aie a me ke kuala. Ehia na makahiki o kana aie ana?

82. Ehia na makaniki o ka aie ana e lilo ai $780 i huiia me ke kuala i $1014, ma ke 6 hapa 100 ke kuala o ka mak. 1?

Ke hoike nui kela mau haawina mamua aku nei, i ke ano o ka hana ana e loaa'i na kumu hana, ma ka hoailona ana.

Ano la, e huli aku ka haumana i hope ma ka Mokuna 8, a e hoailona like i na haawina i kahaia i ka hoku (*); alaila e hana ia mau haawina me na huahelu, mahope o ia mau kumu hana. Pela no ia e makaukau ai no ka hoailona i na haawina e ae iloko o ua mokuna la, i na mea i kaha ole ia.

O NA MOLE

O

KE ANAHONUA.

A. M. Legendre i unuhiia.

LAHAINALUNA.

.....

1843.

O NA MOLE O KE ANAHONUA.

BUKE I.

NA HUA MUA.

He mau Hoakaka.

1. O ke *Anahonua* ka mea e i ike ai ke ano o na mea i hoopalahalahaia, oia na kaha, a me na ili, a me na paa.

E nolu mau ano o na mea i hoopalahalahaia, he loa, he laula, a he manoanoa.

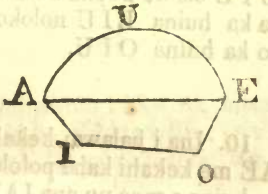
2. *O ke kaha*; he loa wale no ko ke kaha; aole laula, aole manoanoa.

O na welau o ke kaha he mau kiko ia: nolaila, o ke kiko, aole ona loa, aole laula, aole manoanoa, aka he wahi e ku wale ai no.

3. *O ke kaha pololei* ka loa pokole mai kekahi kiko a i kekahi kiko.

4. O ke kaha pololei ole, a i hui ole ia na kaha pololei, *he kaha poai* ia

Penei, AE he kaha pololei ia; AIOE he kaha hakiia oia, i huiia na kaha pololei AI, IO, OE; AUE he kahapoai ia.



Ina ma keia palapala, ua loaa ka olelo *kaha* wale no, ua manaoia he kaha pololei;

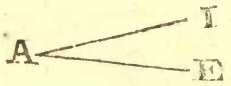
5. *O ka ili* ; he loa ko ka ili a me ka laula, aole nae he manoanoa.

6. *O ka ililaumania,* oia ka ili e moe palahalaha ana kona kukulu, aole kekee, pili no ke kaha pololei ma na wahi a pau mai kekahi aoao a i kekahi aoao.

7. *O ka ilihualala;* hamo mau no kona kukulu me he poepoe la.

8. O ka mea *paa;* he *loa* ko ka paa, a he *laula,* a he *manoanoa* hoi; nolaila ua komo iloko o ka mea paa na ano ekolu o na mea i hoopalahalahaia.

9. Ina i halawai na kaha pololei elua AE, AI, ua kapaia ke kowa mawaena o laua he huina, a ua nui ka huina a uuku paha e like me ka aneane pili a me ke akea o ia mau kaha.

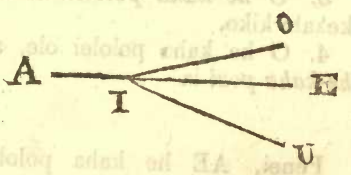


O ke kiko A kahi e oki ai keia mau kaha kekahi i kekahi ua kapaia oia he *kihe,* a ua kapaia hoi na kaha AI, AE na aoao, a he *wawae* paha.

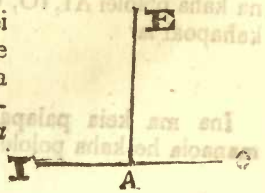
Ua hoikeia mai ka huina i kekahi manawa ma ka hua hookahi ma ke kihe A : a i kekahi manawa ua hoikeia mai ma na hua ekolu I A E, E A I ma ke kihe a me kona mau wawae, o ka hua mawaena oia ka hua ma ke kihe.

Ua hiki no na huina, e like me na mea e ae, ke houluuluia, ke hoolaweia, ke hoonuiia, a ke puunaueia hoi.

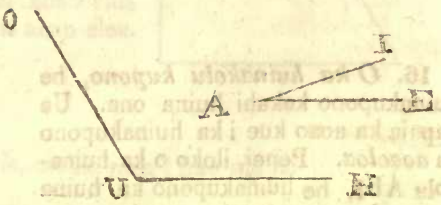
Penei, o ka huina OIU oia ka houluulu ana o na huina O-IE a me EIU : a o ka huina O I E oia ke koena ke hoolawe ia ka huina E I U noloko mai o ka huina O I U.



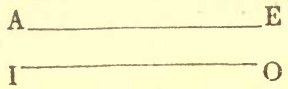
10. Ina i halawai kekahi kaha pololei AE me kekahi kaha pololei IO, a ua like na huina e moe pu ana IAE, EAO; alaila ua kapaia kela huina keia huina he *huina kupono,* a o ke kaha A E he *kaha kupono* ia i ke kaha I O.



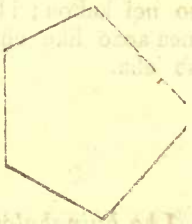
11. O na huina a pau e like me E A I i uuku iho i ka huina kupono, ua kapaia he *huina oi*; a o na huina a pau e like me O U H i nui aku i ka huinakupono, ua kapaia he *huina peleleu.*



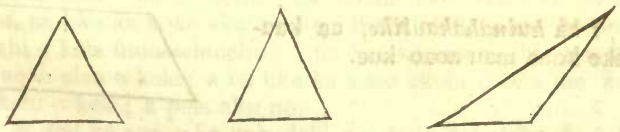
12. *O na kaulike*; oia na kaha e moe like ana, aole i hui pu aole e kaawale ae ke hooloihi mau aku ia, me AE, I O.



13. O ke *kii laumania*; ua hoopuniia oia e na kaha pololei a ua kapaia oia he *kii kaha pololei*, a he *huinalehulehu*, a o na kaha i huiia oia kona *anapuni.*

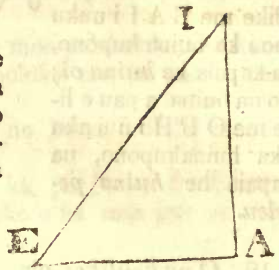


14. O ka huinalehulehu ekolu ona aoao, ua kapaia he *huinakolu*; a ina eha ona aoao, he *huinaha*; a ina elima kona aoao, he *huinalima*; a ina eono, he *huinaono*; ina ehiku, he *huinahiku*; ina ewalu, he *huinawalu*; a pela aku no.



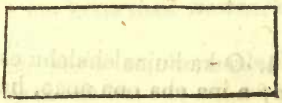
15. O ka *huinakolulike*, oia ka huinakolu i like na aoao a pau kekahi me kekahi. O ka *huinakolu eluaaoaolike*, oia ka mea i like na aoao elua. O ka *huinakolu aoaolikeole*, oia ka mea i like ole na aoao a pau.

16. *O ka huinakolu kupono,* he huinakupono kekahi huina ona. Ua kapaia ka aoao kue i ka huinakupono ka *aoaoloa.* Penei, iloko o ka huinakolu AEI, he huinakupono ka huina A, a o ka aoao E I ka aoao loa.

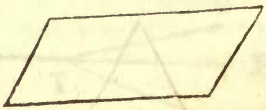


17. Iloko o na huinaha, ke hoomaopopo nei kakou; i ka *huinahalike,* oia ka mea aoao like eha, a me na huinakupono eha.

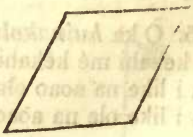
I ka *huinahaloa,* he mau huinakupono kona mau huina eha, aka aole i like kona mau aoao.



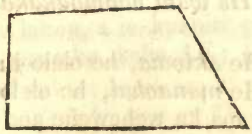
I ka *huinahakaulike,* ua kaulike kona mau aoao kue.



I ka *huinahahio,* ua like no kona mau aoao eha, aka, aole he huinakupono kona mau huina.

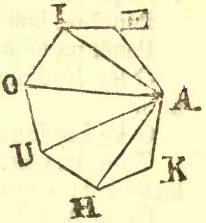


I ka *huinahalualike*, oia ka mea i kau like ia na aoao elua a ua kau like ole hoi na aoao elua.



I ka *huinahalike ole*, oia ka mea i like ole na aoao a me na huina.

18. O ke *kaha kapakahi*, oia ke kaha e moe ana mai kekahi huina a i kekahi huina e, aole nae he mau huina moe pu laua; penei AI, AO, AU, AH, he mau kaha kapakahi lakou.



19. O ka *huinalehulehu aoaolike*, ua like kona mau aoao ma ka loa.

A o ka *huinalehulehu huinalike*, ua like kona mau huina a pau.

20. O *na huinalehulehu aoao like aku like mai*, oia no na huinalehulehu elua i like na aoao o kekahi me ko kekahi ke helu like ia laua; oia no keia; i ka hahai like ana i ko laua anapuni, ua like ka aoao akahi o keia huinalehulehu me ka aoao akahi o kela huinalehulehu; a ua like ka aoao elua o keia me ka aoao elua o kela; a ua like ka aoao ekolu o keia me ka aoao ekolu o kela; a pela aku no.

Pela no hoi ke ano o ka hua olelo *na huinalehulehu huina i like aku like mai.*

Ma keia mau mea elua, ua kapaia na aoao like *na aoao homoloko*, a o na huinalike *na huina homoloko.*

21. He *manao koho wale*, he manao hoike wale ia, aole nae i maopopo kona oiaio.

He wahi hoomoakaka i na huaolelo ma ka Anahonua.

He *akioma*, he olelo i maopopo wale iho no kona oiaio ana.

He *manaohai*, he olelo oiaio no ia, i hiki ke hoomaopopoia mai ma ka wehewehe ana o ka manao.

He *nanehai*, he ninau ia, e pono ke wehewehe ia.

He *manaopili*, he mea ia e ulu maopopo mai ana, noloko mai o kekahi manaohai, nanehai paha, i wehewehe mua ia.

He *wehewehe*, he olelo ia e hoakaka ana i ka pili ana a me ke ano o kekahi mau manaohai a me na nanehai i hoike e ia.

Kuaniti, o ka nui ia o kekahi mea i oleloia, o ka ili paha, o ka paa paha.

He olelo hoakaka i na hoailona.

O ka hoailona = oia ka hoailona o ka like pu ana; Penei A = E, Eia ke ano, ua like A me E.

Penei ua hoikeia, ua uuku iho o A ia E, A ⌊ E.

Penei ua hoikeia, ua nui ae o A ia E, A ⌉ E.

O ka hoailona + ua kapaia *he hui aku*, he houluulu kona ano.

O ka hoailona — ua kapaia *he emi*, he unuhi kona ano.

O ka hoailona + (hui aku) a me ka hoailona — (emi) ua kauia laua mamua o ka mea e houluuluia'i, a e laweia'i.

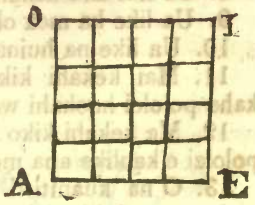
Penei A + E o ka houluulu ana no ia o A a me E; A — E o ke koena no ia ke hoolaweia o E noloko mai o A: A — E + I, oia hoi A + I — E, eia ke ano, o E ke unuhiia no loko mai o ka houluulu ana o A a me I.

O ka hoailona × ka hoonui. Penei A × E o ka hoonuiia o A a me E. A i ole ka hoailona ×, a he kiko wale no paha, penei A. E: ua hoikeia hoi keia hoonui ana me ka hoailona ole, penei A E: aka aole pono ke hoikeia ka hoonui me ka hoailona ole, ke hihia ia me kekahi kaha A E e moe ana mawaena o A a me E.

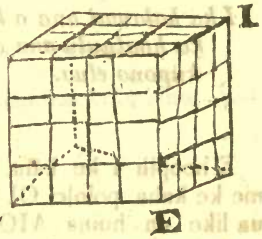
Ma na hua A × (E + I — O) ua hoikeia ka hoonui ana o A me ka mea iloko o ke apowaena; houluuluia o E a me I, a noloko olaila ua unuhiia o O, a o ke koena ua hoonuiia aku me A. Ina i makemakeia e hoike i ka hoonui ana o A + E me A — E + I, penei ia kakau ana (A + E) × (A — E + I). O na mea iloko o ke apowaena, ua manaoia lakou me he hua hookahi la.

O ka huahelu i kauia mamua o kekahi kaha, o kekahi kua-

niti paha he hua hoonui aku oia ia lakou, a ia kuaniti paha; penei, 3 AE eia ke ano, ekolu lawe ana o ke kaha AE; ½ A o ka hapalua ia o ka huina A.



O ka huinahalike AEIO i kauia ma ke *kumukaha* AE, ua hoikeia penei AE^2; a ua kapaia oia, o ka *kuea* o AE; o ka hoonui ana no ia o ke kaha AE me ia iho AE × AE. Ina eha kapuai ka loa o ke kumukaha AE, alaila ua like AE^2 me 4 × 4 = 16 o ka huinahalike AEIO no ia, o ke *kuea* o AE.



O ka *paailiono like* AI i kauia ma ke *kumukaha* AE, ua hoikeia penei AE^3; a ua kapaia oia o ke *kuba* o AE; alua keia hoonui ana o ke kumukaha AE me ia iho AE × AE × AE. Ina eha kapuai ka loa o ke kumukaha AE, alaila ua like AE^3 me 4 × 4 × 4 = 64, o ka *paailionolike* AI no ia, o ke *kuba* o AE.

O ka hoailona $\surd$ ka hoailona o ka unuhi ana o ke kumukaha: penei $\surd$A e unuhiia ke kumukaha o ka huinahalike A; a ua kapaia $\surd$A o ke *kumukaha kuea* o A.

Eia hoi $\sqrt[3]{}$A e unuhiia ke kumukaha o ka paailionolike A; a ua kapaia $\sqrt[3]{}$A o ke *kumukaha kuba* o A.

Na Akioma.

1. O na mea okoa i like loa me kekahi mea e ae, ua like ia mau mea okoa kekahi me kekahi.
2. Ina i houluuluia na mea like, me na mea like e ae, alaila, ua like na mea i loaa.
3. Ina i laweia na mea like no loko mai o na mea like, alaila, ua like na koena.
4. Ina i houluuluia na mea like me na mea like ole, alaila ua like ole na mea i loaa.

5. Ina i laweia na mea like no loko mai o na mea like ole, alaila ua like ole na koena.

6. O na mea i palua i kekahi mea e ae, ua like lakou.

7. O na mea i hapalua o kekahi mea e ae, ua like lakou.

8. Ua nui aku kekahi mea okoa i kekahi apana ona.

9. Ua like ka mea okoa me kona mau apana a pau ke huiia.

10. Ua like na huina kupono a pau.

11. Mai kekahi kiko a i kekahi kiko, e hiki ke kaha i ke kaha pololei hookahi wale no.

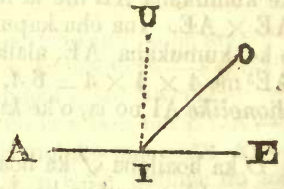
12. Ma kekahi kiko e hiki ke kaha i hookahi wale no kaha pololei e kaulike ana me kekahi kaha pololei e ae i hoakakaia.

13. O na kuaniti i hoopiliia kekahi me kekahi, a ku like mai o a o, ua like lakou.

MANAOHAI 1.

I ka halawai ana o kekahi kaha pololei me kekahi, ua like ka houluulu ana o na huina e moe pu ana me na huina kupono elua.

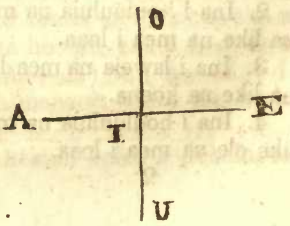
E hoopili i ke kaha pololei AE me ke kaha pololei OI ma I, alaila ua like na huina AIO + OIE me na huina kupono elua.



Ma ke kiko I e kukulu ae i ke kaha IU e kupono ana i ke kaha AE. O ka huina AIO oia ka houluulu ana o na huina AIU + UIO; nolaila AIO + OIE oia ka houluulu ana o na huina ekolu AIU, UIO, OIE; aka o ka mua o keia AIU he huina kupono ia, a o ka hui ana o na huina elua i koe ka huina kupono UIE; nolaila ua like ka houluulu ana o na huina elua o AIO + OIE me na huina kupono elua.

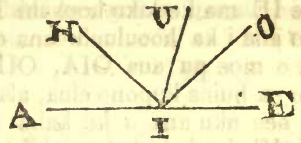
Manaopili 1. Ina he huina kupono kekahi o na huina A I O, OIE, alaila he huina kupono no hoi kekahi.

Manaopili 2. Ina i kupono ke kaha OU ia AE, alaila ua kupono no hoi ke kaha AE ia OU.



No ka mea, ma ke kupono mai ana o OU ia AE ua like na huina AIO, OIE, a he mau huina kupono laua (Hoak. 10) He huina kupono AIO, nolaila he huina kupono kona huina e moe pu ana AIU (*Manaopili* 1.) Nolaila ua like ka huina AIO, me ka huina AIU (Akioma 10): nolaila ua kupono AE ia OU.

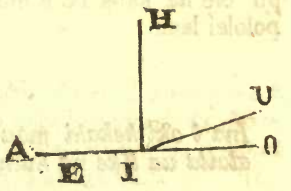
Manaopili 3, Ua like ka houluulu ana o na huina a pau AIH, HIU, UIO, OIE ma kekahi aoao o ke kaha AE me na huina kupono elua; no ka mea, ua like ka houluulu ana o lakou a pau me na huina e moe pu ana AIH, HIE.



MANAOHAI II.

Elua mau kaha pololei e pili ana ma na kiko elua, hookahi no kaha pololei laua.

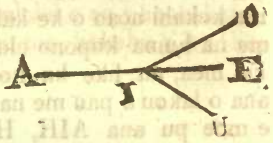
E lawe ia A a me E i mau kiko elua kahi e pili ai ia mau kaha pololei elua. Ua maopopo ka pili pu ana o keia mau kaha mawaena o na kiko A a me E, no ka mea, ina aole pili pu ina ua kahaia na kaha pololei elua mawaena o A a me E, he mea hiki ole ia (Akioma 11). He manao koho wale nae, i ke kaha hou ana,



ua hoomaka keia mau kaha e kaawale ae kekahi i kekahi ma I, o IO kekahi a IU kekahi. Mai ke kiko I e kaha i ke kaha IH e kupono ana ia AI, alaila o ka huina AIH he huina kupono ia. Eia hoi, he kaha pololei AIO, nolaila he huina kupono ka huina HIO (Manaohai 1. Manaopili 1.). He kaha pololei hoi AIU; nolaila, he huina kupono ka huina HIU. Nolaila ua like ka huina HIO me ka huina HIU (Akioma 10); he mea hiki ole ke pili pu ole na kaha pololei IO a me I U; nolaila o na kaha pololei e pili ana ma na kiko A a me E, aole e hiki ia laua ke kaawale ae ma kekahi kiko ke hooloihiia; nolaila hoi, hookahi kaha pololei laua,

MANAOHAI III.

Ina i halawai kekahi kaha pololei me na kaha pololei e ae elua, ma ke kiko hookahi, e hoolilo ana i ka houluulu ana o na huina e moe pu ana e like me na huina kupono elua, alaila o ia mau kaha pololei elua i halawaiia, hookahi no kaha pololei laua.



E hoohalawai i ke kaha pololei IO me na kaha pololei e ae elua AI a me IE ma ke kiko hookahi I, e hoolilo ana i ka hoouluulu ana o na huina e moe pu ana OIA, OIE e like me na huina kupono elua, alaila o I E ka nee aku ana o ke kaha AI, AI a me IE hookahi kaha pololei laua.

Ina aole IE ka nee aku ana o AI, e hoonee aku ia ia ma IU, alaila o ke kaha AIU he kaha pololei ia, nolaila o ka houluulu ana o na huina AIO a me OIU ua like me na huina kupono elua (Manaohai 1). Aka ua like na huina AIO + OIE me na huina kupono elua, nolaila ua like AIO + OIU me AIO + OIE; e lawe i ka huina AIO mai keia mau mea la, a ua koe ka huina OIU = OIE, he mea hiki ole ke kau pu ole na kaha IE a me IU; nolaila AI, IE, hookahi kaha pololei laua.

MANAOHAI IV.

Ina i oki kekahi mau kaha pololei elua kekahi i kekahi, alaila ua like na huina kue.

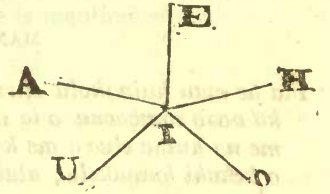
E kau mai i na kaha pololei elua AE a me OU e oki ana kekahi i kekahi ma I; alaila ua like ka huina AIU me kona huina kue OIE, a ua like AIO me EIU.

No ka mea, no ka halawai ana o ke kaha pololei AI me ke kaha pololei OU ua like ka houluulu ana o na huina OIA AIU me na huina kupono elua (Manaohai I); a no ka halawai ana o ke kaha pololei UI me ke kaha pololei AE ua like

ka houluulu ana o na huina AIU, UIE, me na huina kupono elua; nolaila o na huina AIU + UIE ua like me OIA + AIU (Akioma 1.) E lawe aku i ka huina AIU mai keia mau mea la, a koe no ka huina UIE = OIA kona huina kue (Akioma 3).

He Wehewehe. Ua like na huina eha ma ke kiko, kahi e oki ai na kaha pololei elua kekahi i kekahi, me na huina kupono eha: no ka mea, o ka hoouluulu ana o na huina elua AIU, UIE ua like me na huina kupono elua; a ua like ka houluulu ana o ia mau huina elua i koe AIO a me OIE me na huina kupono elua: nolaila ua like ka houluulu ana o ia mau huina eha me na huina kupono eha.

Pela hoi, ina he nui na kaha pololei AI, IE, IH, IO, IU, i halawai ma ke kiko I, ua like ka houluulu ana o na huina a pau AIE, EIH, HIO, OIU, UIA me na huina kupono eha, no ka mea ina i hanaia na

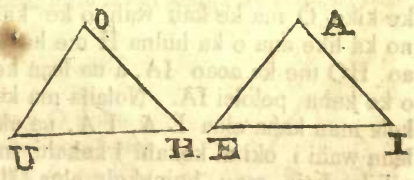


huina kupono eha ma ke kiko I me na kaha pololei elua i kupono kekahi i kekahi, ina ua paapu ia mau huina kupono eha, e like me ka paapu ana i keia mau huina a pau AIE, EIH, HIO, OIU, UIA.

MANAOHAI V.

Ina he mau huinakolu elua, a ua like na aoao elua a me ka huina iwaena o ia mau aoao o kekahi huinakolu, me na aoao elua a me ka huina iwaena o ia mau aoao o kekahi huinakolu, alaila ua like ia mau huinakolu.

I like ka aoao UO me ka aoao EA, a o ka aoao OH me ka aoao AI, a o ka huina A me ka huina O; alaila ua like ka huinakolu AEI me ka huinakolu OUH.



No ka mea, ua hiki ke hoopili i keia mau huinakolu kekahi

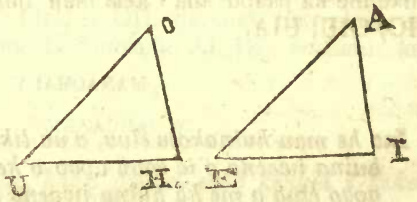
me kekahi, a pili like loa kekahi me kekahi. E kau i ka huinakolu OUH maluna o ka huinakolu AEI i kupono ke kiko O me ke kiko A, a i pili hoi ka aoao OU me ka aoao AE; alaila no ka like ana o ka huina O me ka huina A ua moe like ka aoao OU me ka aoao AI. Aka ua like OH a me AI; nolaila ua pili ke kiko H me ke kiko I, a ua pili ka aoao ekolu UH me ka aoao ekolu E I (Akioma 11.): nolaila ua like ka huinakolu AEI me ka huinakolu OUH (Akioma 13.).

Manaopili. Ina he mau huinakolu elua, a ua like keia mau mea ekolu, o ka aoao AE = OU, a o ka aoao AI = O H, a o ka huina A = O, alaila ua like hoi na mea ekolu i koe, ka aoao EI = UH, a o ka huina E = U a o ka huina I = H.

MANAOHAI VI.

Ina he mau huinakolu elua, a ua like na huina elua a me ka aoao mawaena o ia mau huina o kekahi huinakolu, me na huina elua a me ka aoao mawaena o ia mau huina o kekahi huinakolu; alaila ua like ia mau huinakolu

I like ka huina U me ka huina E, a me ka huina H me ka huina I, a me ka aoao UH me ka aoao EI; alaila ua like ka huinakolu OUH me ka huinakolu AEI.



No ka mea, i ka hoopili ana i kekahi me kekahi, e kau i ka aoao UH maluna iho o EI i pili ke kiko E me ke kiko U, a me ke kiko I me ke kiko H; alaila no ka like ana o ka huina E e moe like ka aoao UO me ka aoao EA, a nolaila ua loaa ke kiko O ma ke kau wahi o ke kaha pololei EA. Pela hoi, no ka like ana o ka huina H me ka huina I ua moe like ka aoao HO me ka aoao IA, a ua loaa ke kiko O ma ke kau wahi o ke kaha pololei IA. Nolaila ma ke kau ana o ke kiko O ma keia mau kaha elua E A, I A, ua akaka kona kau ana ma ko laua wahi i oki ai kekahi i kekahi ma ke kiko A: nolaila ua pili loa keia mau huinakolu elua OUH, AEI kekahi me kekahi, a ua like laua (Akioma 13)

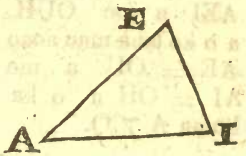
Manaopili. Ina he mau huinakolu elua, a ua like keia mau mea ekolu, o ka huina U = E, a o ka huina H = I, a o ka aoao mawaena UH = EI; alaila ua like na mea ekolu i koe kekahi me kekahi, o ka huina O = A, a o ka aoao UO = EA, a o ka aoao OH = AI.

He Wehewehe. Ina i hoopiliia na huinakolu elua, a pili like laua, alaila ua iia laua *ua like* (Ak. 13). Nolaila, iloko o na huinakolu like, ua like ko lakou mau apana ano like ko kekahi me ko kekahi, no ka mea, e pili like ia mau apana ano like kekahi me kekahi. Pela hoi, ina ua like na apana ano like a pau o kekahi mau huinakolu, kekahi me kekahi, alaila ua like ia mau huinakolu; no ka mea, ina i hoopiliia laua kekahi me kekahi, ina ua pili like ia mau huinakolu.

MANAOHAI VII.

Ua nui aku ka houluulu ana o na aoao elua o ka huinakolu, i ka aoao ekolu.

I huinakolu AEI, alaila ua nui aku ka houluulu ana o na aoao elua AE, EI i ka aoao ekolu AI

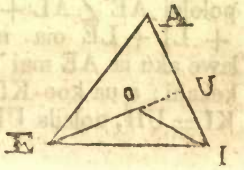


No ka mea, o ke kaha pololei AI ka loa pokole iwaena o na kiko A a me I (Hoakaka 3.); nolaila ua nui aku AE + EI ia AI.

MANAOHAI VIII.

Ina iloko o kekahi huinakolu, e kahaia na kaha pololei elua mai kekahi kiko a i na welau o kekahi aoao o ka huinakolu; alaila ua uuku iho ka houluulu ana o keia mau kaha i ka houluulu ana o na aoao elua e ae o ua huinakolu nei.

E koho wale i kekahi kiko O iloko o ka huinakolu AEI, a e kaha i na kaha OE, OI, i na welau o kekahi aoao EI; alaila OE + OI ∠ AE + AI.



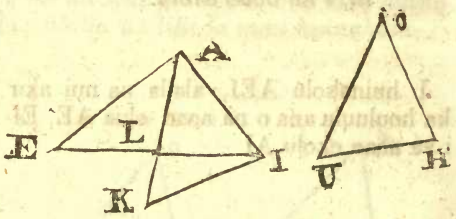
E hoonee aku i ke kaha EO a hiki i ke kaha AI ma U: alaila, ua uuku iho ke kaha OI ia O U + UI (Manaohai VII.): e hui aku ia EO me ia mau mea elua, alaila EO + OI ∠ EO + OU + UI (Akioma 4.), oia no EO + OI ∠ EU + UI.

Eia hoi EU ∠ EA + AU: e hui aku ia UI ia mau mea, alaila EU + UI ∠ EA + AI. Aka ua hoikeia iho nei EO + OI ∠ EU + UI; nolaila ua akaka lea EO + OI ∠ EA + AI.

MANAOHAI IX.

Iloko o na huinakolu elua, ina ua like na aoao elua o kekahi me na aoao elua o kekahi, a ua like ole na huina iwaena o ia mau aoao, alaila ua like ole ka aoao ekolu; a o ka huinakolu ia ia ka huina nui ae iwaena o na aoao, nona no hoi ka aoao i nui aku.

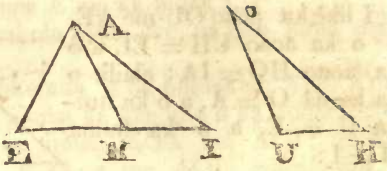
I mau huinakolu AEI a me OUH, a o ko laua mau aoao AE = OU a me AI = OH a o ka huina A ⁊ O.



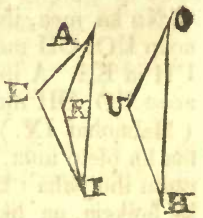
E hana i ka huina IAK = O; a e lawe ia AK = OU, a e kaha i ke kaha IK. Ua like ka huinakolu KAI me ka huinakolu OUH, no ka mea ua like na aoao elua a me ka huina mawaena o kekahi me na aoao elua a me ka huina iwaena o kekahi (Manaohai V.): nolaila ua like KI me UH. Iloko o keia, ekolu hana ana e like me kahi e kau ai ke kiko K; ua kau paha mawaho o ka huinakolu AEI, a ua kau paha ma ka aoao moe EI, a ua kau maloko paha o ka huinakolu.

Ka hana mua. Ua kau ke kiko K mawaho o ka huinakolu AEI. O ke kaha pololei KI ∠ KL + LI, a o ke kaha pololei AE ∠ AL + LE, nolaila KI + AE ∠ KL + LA + LI + LE oia no keia KI + AE ∠ KA + EI. E lawe aku ia AE mai kekahi aoao aku, a ia KA kona like mai kekahi; a ua koe KI ∠ EI (AK. 5): aka ua loaa ia kakou KI = UH, nolaila UH ∠ EI.

Ka hana lua. Ina i kau ke kiko K ma ka aoao EI, ua akaka wale no, ua uuku iho KI a o kona like hoi UH ia EI (Akioma 8.).



Ka hana akolu. Ina i kau ke kiko K maloko o ka huinakolu AEI, ua akaka, ma ka manaohai VIII, AK + KI ∠ AE + EI: e lawe ia AK mai kekahi aku, a i kona like AE mai kekahi aku, a koe mai KI ∠ EI, oia no EI ⊿ UH.



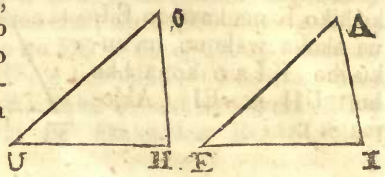
He Wehewehe. Ina ua like na aoao elua EA, AI o ka huinakolu AEI me na aoao elua UO, OH o ka huinakolu OUH, a ua nui aku ka aoao ekolu EI o ka huinakolu mua i ka aoao ekolu UH o ka huinakolu alua; alaila ua nui aku ka huina EAI ia UOH.

Ina aole i nui aku ka huina EAI i ka huina UOH ua like laua, a i ole ia ua uuku iho ka huina EAI ia UOH; ina ua like, alaila ua like ka aoao EI me UH (Manaohai V): a ina ua uuku iho ka huina EAI ia UOH alaila, ua uuku iho ka aoao EI ia UH, aka ma ka olelo mua ana, ua nui aku; nolaila ua nui aku ka huina EAI i ka huina UOH.

MANAOHAI X.

Ina ua like na aoao ekolu o kekahi huinakolu me na aoao ekolu o kekahi huinakolu ko kekahi me ko kekahi, alaila ua like hoi na huina ekolu o kekahi me na huina ekolu o kekahi; a ua like hoi keia mau huinakolu kekahi me kekahi.

I like ka aoao OU me AE, a o ka aoao UH = EI, a o ka aoao HO = IA: alaila o ka huina O = A, a o ka huina U = E, a o ka huina H = I:



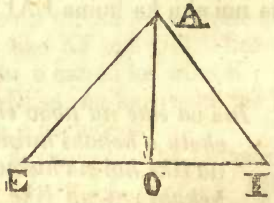
No ka mea, ina ua nui aku ka huina O ia A, a ua like na aoao UO, OH me na aoao EA, AI, alaila ua nui aku ka aoao UH ia EI. A ina ua uuku iho ka huina O ia A, a ua like na aoao UO, OH me EA, AI, alaila ua uuku iho ka huina O ia A (Manaohai IX.); aka ua like ka aoao UH me ka aoao EI, ma ka olelo mua, nolaila aole hiki ka huina O ke nui aku, a ke uuku iho paha i ka huina A, nolaila ua like laua. Pela ua hiki ke hoikeia, ua like ka huina U me ka huina E, a ua like ka huina H me ka huina I; nolaila hoi ua like keia mau huinakolu kekahi me kekahi (Manaohai VI. Wehewehe.)

He Wehewehe. He pono ke hoomaopopoia, o na huina like, ua kue lakou i na aoao like: penei, o na huina like O a me A, ua kue laua i na aoao like UH a me EI.

MANAOHAI XI.

Iloko o ka huinakolu elua aoao like, ua like na huina kue i na aoao like.

I like ka aoao EA me ka aoao AI, alaila ua like ka huina E me ka huina I.



No ka mea, e kaha i ke kaha AO mai ke kihi A a i ke kiko mawaenakonu o ka aoao EI. Alaila ua like na aoao ekolu o ka huinakolu AEO me na aoao ekolu o ka huinakolu AOI; no ka mea ua like AE me AI ma ka olelo mua; a o ka aoao AO oia kekahi aoao o ia mau huinakolu elua; a ua like EO

me OI, no ka mea, ua mahele like ia o EI. Nolaila, ma ka *manaohai* X, ua like ka huina E me ka huina I.

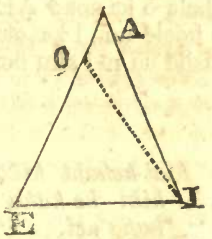
Manaopili. O ka huinakolu aoao like, ua like kona mau huina a pau.

He Wehewehe. Ma ka like ana o na huinakolu AEO a me AOI, kekahi me kekahi, ua akaka ka like ana o ka huina EAO me OAI, a ua like hoi ka huina EOA me AOI; nolaila hoi he mau huinakupono EOA a me AOI: *nolaila hoi, o ke kaha i kahaia mai ke kihi o ka huinakolu elua aoao like a i ke kiko mawaena konu o ka wawae, ua kupono ia kaha i ka wawae, a ua mahele hoi oia i ka huina ma ke kihi i mau huinalike.*

MANAOHAI XII.

Ina ua like na huina elua o kekahi huinakolu, alaila ua like hoi na aoao kue ia mau huina, a he huinakolu elua aoao like ia.

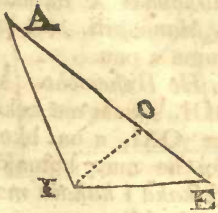
I like ka huina AEI me ka huiua AIE; alaila ua like ka aoao AE me ka aoao AI.



No ka mea, ina aole i like keia mau aoao, e koho wale ia AE ka aoao i nui ae. Alaila, e lawe ia EO = AI, a e kaha i ke kaha IO. Eia hoi, iloko o na huinakolu elua EOI a me EAI, ua loaa keia EO = AI; a ua like ka huina E me ka huina AIE ma ka olelo mua, a o ka aoao EI he aoao ia o laua a elua: nolaila iloko o keia mau huinakolu, ua like na aoao elua a me ka huina iwaena o ia mau aoao o kekahi huinakolu, me na aoao elua a me ka huina iwaena o ia mau aoao; nolaila, ua like keia mau huinakolu (Manaohai V.). Aka aole hiki ke apana ke like me ka mea okoa (Ak. 8; nolaila aole he like ole na aoao EA, AI; nolaila hoi he huinakolu elua aoao like ka huinakolu AEI.

MANAOHAI XIII.

Iloko o na huinakolu a pau, ua kue ka aoao nui i ka huina nui: a ua kue ka huina nui i ka aoao nui.



Akahi. I nui aku ka huina I ia E; alaila, o ka aoao AE ka i kue ia I, ua nui aku ia ia AI ka i kue ia E.

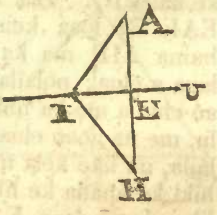
No ka mea, e hana i ka huina EIO = E. Alaila, iloko o ka huinakolu IOE, IO = OE (Manaohai XII). Eia hoi, o ka aoao AI ∠ AO + OI; aka AO + IO = AO + OE = AE: nolaila AI ∠ AE.

Alua. I nui aku ka aoao AE ia AI; alaila ua nui aku ka huina I ka i kue ia AE, i ka huina E ka i kue ia AI.

No ka mea, ina o ka huina I ∠ E, alaila ua akaka AE ∠ AI; he mea ia e hoole ana i ka olelo mua. Ina hoi ka huina I = E, alaila o ka aoao AE = AI (Manaohai XII.); he mea hoi ia e hoole ana i ka olelo mua. Nolaila ina i nui aku AE ia AI, alaila ua nui aku hoi ka huina I ia E.

MANAOHAI XIV.

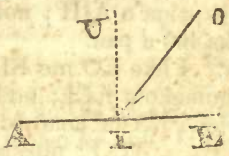
Mai kekahi kiko mawaho aku o kekahi kaha pololei, ua hiki ke kaha i ke kaha hookahi wale no i kupono i ua kaha nei.



Eia ke kiko, o A, a o OU ke kaha pololei. E koho wale kakou, ua hiki no ke kaha i elua kaha kupono AE, AI. E hooloihi aku i kekahi o laua, ia AE paha a like EH me AE; a e kaha i ke kaha HI. Alaila, ua like na huinakolu AIE a O me HIE; no ka mea, he mau huinakupono na huina AEI, IEH, a o ka aoao IE, he aoao ia o ia mau huinakolu a elua, a ua like AE me EH, ma ka hana ana; nolaila ua like keia mau huinakolu, a o ka huina, AIE = EIH (Manaohai V. Manaopili). Aka he huinakupono ka huina AIE, ma ka olelo mua; nolaila hoi, he huinakupono ka huina EIH. Aka ina ua like ka houluulu ana o na huina moe pu AIE, EIH me na huinakupono elua, alaila he kaha pololei ke

kaha AIH (Manaohai III: nolaila hoi, iwaena o na kiko elua A a me H, ua hiki no ke kaha i elua mau kaha pololei, o ka mea hiki ole ia (Akioma 11.): nolaila aole hiki ke kahaia elua kaha kupono mai ke kiko hookahi a i ke kaha pololei hookahi.

He Wehewehe. Ma kekahi kiko I iloko o ke kaha AE, aole hiki ke kukulu ae i elua kaha kupono ia AE. No ka mea ina o IU, IO ia mau kaha kupono ia AE, alaila he mau huina kupono ka huina EIO, a me EIU; a nolaila ua like laua (Ak. 10) a ua pili pu ke kaha IO me ke kaha IU; a i ole ia, ua like ka apana me ka mea okoa, o ka mea hiki ole ia Ak. 8).



MANAOHAI XV.

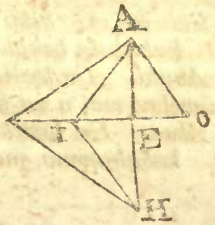
Ina mai kekahi kiko mawaho aku o kekahi kaha pololei, e kahaia ke kaha kupono i ua kaha nei; a i kahaia hoi kekahi mau kaha hio a i kekahi mau kiko o ua kaha nei: alaila.

Akahi. Ua pokole iho ke kaha kupono i na kaha hio a pau.

Alua. Ua like na kaha hio elua i kauia, ma kela aoao, ma keia aoao o ke kaha kupono e hooki ana i na loa like o kela kaha.

Akolu. O na kaha hio i kauia mai, o ke kaha i kaawale nui i ke kaha kupono, oia ka mea i oi aku kona loa.

Eia ke kiko, o A, a UO ke kaha i haawiia. AE ke kaha kupono ia UO: a o AU, AI, AO kekahi mau kaha hio.



E hoonee aku i ke kaha kupono AE, a like EH me EA. E kaha i na kaha HI, HU.

Akahi. Ua like ka huinakolu EIH me ka huinakolu EIA, no ka mea, ua loaa ia laua ka huinakupono IEH = IEA, a o ka aoao IE, oia kekahi aoao o ia mau huinakolu a elua, a ua like ka aoao EH me ka aoao EA: nolaila ua like ke kolu o na aoao IH a me IA (Manaohai V. Manaopili). Aka ua pokole iho ke kaha pololei AEH i ke kaha hakiia AIH (Hoakaka 3): nolaila ua pokole iho o AE, o ka hapalua o AH, ia AI, ka hapalua o AIH; nolaila, ua pokole iho ke kaha kupono i na kaha hio a pau.

Alua. I like EO me EI; alaila ua like ka huinakolu AEO me ka huinakolu AEI; no ka mea, ua like ka aoao EO me EI, a o ka aoao EA he aoao ia o ia mau huinakolu a elua; a o ka huina IEA = AEO; nolaila ua like na aoao AI, AO (Manaohai V. Manaopili); nolaila ua like na kaha hio elua ma kela aoao o ke kaha kupono kekahi, a ma keia aoao kekahi, ke like ko laua loihi mai ke kaha kupono mai.

Akolu. Ma ka huinakolu AUH, ua uuku iho ka houluulu ana o na kaha AI, IH i ka houluulu ana o na aoao AU, UH (Manaohai VIII.); nolaila ua uuku iho AI ka hapalua o ka houluulu ana o AI, IH, ia AU ka hapalua o ka houluulu ana o AU, UH: nolaila ua oi aku ka loa o ke kaha hio i loihi aku i ke kahakupono, i ka loa o ke kaha hio i kokoke ae i ke kahakupono.

Manaopili 1, o ke kaha kupono, oia ke kaha pokole loa, mai kekahi kiko a i kekahi kaha.

Manopili 2. Mai kekahi kiko a i kekahi kaha pololei, ua hiki ke kaha i na kaha like, elua wale no: no ka mea, ina he nui aku no, alaila ua hiki ke kaha i na kaha hio like elua ma kekahi aoao o ke kaha kupono, he mea hiki ole ia.

MANAOHAI XVI.

Ina ma ke kiko mawaenakonu o kekahi kaha pololei, i kukuluia kekahi kaha kupono ia ia; alaila,

Akahi. Ua lualike na kiko a pau o ke kaha kupono, mai na welau mai o ua kaha nei,

Alua. Ua lualike ole na kiko a pau mawaho aku o ke kahakupono, mai na welau mai o ua kaha nei.

Eia ke kaha pololei i haawiia AE, a o I ke kiko mawaenakonu, UIH ke kaha kupono ia ia.

Akahi. No ka like ana o AI, IE, nolaila ua oki na kaha hio AO, OE i na loa like o ke kaha AE mai ke kaha kupono mai, a ua like laua (Manaohai XV). Pela no hoi AU = EU, a o AH = HE, a pela aku no. Nolaila ua like ka loa o na kiko a pau ma ke kaha kupono, mai na welau mai A a me E.

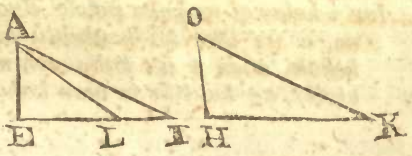
Alua. Eia hoi o K kekahi kiko mawaho aku o ke kaha kupono. Ina i kahaia KA, KE, e oki ana kekahi o laua i ke kaha kupono ma O. E kaha i ke kaha OE, a ua like AO, OE. Aka ua uuku iho ke kaha KE ia KO + OE; a KO + OE = KO + OA = KA: nolaila KE ∠ KA. Nolaila, ua loa like ole na kiko a pau mawaho aku o ke kahakupono mai na welau A, E mai.

Manaopili. Ina ua loa like na kiko elua O a me H o kekahi kaha pololei, mai na welau A, E mai; alaila ua kupono oia ia AE ma kona kiko waena I.

MANAOHAI XVII.

Ina iloko o na huinakolukupono elua, ua like ka aoao loa a me kekahi wawae o kekahi, me ka aoao loa a me kekahi wawae o kekahi; alaila, ua like na mea koe kekahi me kekahi; a ua like hoi keia mau huinakolu, kekahi me kekahi.

Iloko o na huinakolu kupono elua AEI, OHK, i like ka aoao loa AI me ka aoao loa OK, a o AE = O H: alaila o ka aoao EI = HK, a o ka huina A = O, a o ka huina I = K.



Ina ua like ka aoao EI me ka aoao HK, alaila ua like na huina ano like o ia mau huinakolu (Manaohai X). Aka, ina he mea hiki, i like ole keia mau aoao, i nui aku EI ia HK.

Maluna o EI e lawe ia EL = HK, a e kaha ia AL. Alaila, iloko o na huinakolu EAL, OHK, ua like ka huina E me ka huina H, no ka mea, he mau huinakupono laua, a EA = HO ma ka olelo mua, a o ka aoao EL = HK ma ka hana ana, nolaila AL = OK (Manaohai V. Manaopili). Aka ma ka olelo mua AI = OK, nolaila AI = AL (Akioma 1). Aka, aole hiki ke kaha hio AI ke like me ke kaha hio AL, ka mea i kokoke ae i ke kahakupono AE (Manaohai XV.): nolaila aole hiki ke kaha EI ke like ole me HK, nolaila ua like ka huina A me O, a o ka huina I = K; a ua like hoi keia mau huinakolu (Manaohai VI. Wehewehe).

MANAOHAI XVIII.

Ina i kupono kekahi mau kaha pololei elua i kekahi kaha pololei e ae, alaila ua kaulike ia mau kaha kupono.

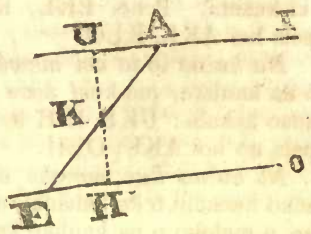
I kupono na kaha pololei AI a me EO me ke kaha pololei EA: alaila ua kaulike AI a me EO.

No ka mea ina he mea hiki ke halawai laua ma kekahi kiko U, alaila ua loaa na kaha elua UA a me UE e kupono mai ana mai ke kiko hookahi a i ke kaha hookahi; he mea hiki ole ia (Manaohai XIV).

MANAOHAI XIX.

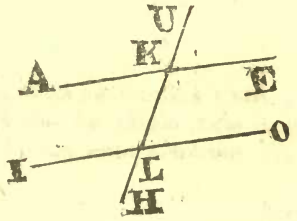
Ina i halawai na kaha pololei elua me kekahi kaha pololei e ae, a ua like ka houluulu ana o na huina iloko ma kekahi aoao o ua kaha nei, me na huinakupono elua; alaila, ua kaulike ia mau kaha pololei elua.

E kau mai i na kaha elua UI a me EO, e halawai pu ana me ke kaha AE, a e hoolilo ana i ka houluulu ana o na huina EAI + AEO = na huinakupono elua; alaila ua kaulike na kaha UI a me EO,



Mai ke kiko K, ke kikowaena o ke kaha AE, e kaha i ke kaha pololei UKH e kupono ana ia UI. E kupono no hoi oia ia EO. No ka mea, ua like ka houluulu ana o na huina EAI + AEO me na huinakupono elua ma ka olelo mua, o ka houluulu ana no hoi EAI + EAU = me na huinakupono elua (Manaohai 1.); E lawe ia EAI mai ia mau mea la elua, a ua koe EAU = AEO. Eia hoi, ua like na huina UKA a me EKH (Manahai IV); nolaila, iloko o na huinakolu AKU, KEH, ua like kekahi aoao a me na huina moe pu o kekahi me ko kekahi; nolaila, ua like ia mau huinakolu, a ua like hoi ka huina KUA me ka huina KHE (Manaohai VI. Manaopili): aka, o ka huina KUA, he huina kupono ia, ma ka hana ana; nolaila hoi, o ka huina KHE he huinakupono ia; nolaila ke kupono nei keia mau kaha UI, a me OE me ke kaha hookahi UH, a nolaila, ke kaulike laua (Manaohai XVIII.

He Wehewehe. Aia i halawaiia na kaha kaulike AE, a me IO e kekahi kaha pololei e ae; o na huina i hanaia ilaila, ua kapaia lakou ma na inoa ponoi.



Na huina iloko ma kahi aoao, oia na huina e moe ana maloko o na kaulike ma ka aoao hookahi o ke kaha oki: penei, LKE, KLO na huina iloko ma kahi aoao: pela no hoi, na huina LKA, ILK.

Na huina io ia nei, ua moe no laua maloko o na kaulike, ma keia aoao o ke kahaoki kekahi, a ma kela aoao o ke kahao-

ki kekahi. Penei EKL, KLI he mau huina io ia nei laua pela hoi AKL, KLO.

Na huina io ia nei mawaho, ua moe no laua mawaho aku o na kaulike, ma keia aoao o ke kahaoki kekahi, a ma kela aoao kekahi: UKE, ILH he mau huina io ia nei mawaho laua; pela no hoi AKU, OLH.

Na huina kue mawaho a maloko; ua moe no laua ma ka aoao hookahi o ke kahaoki, a mawaho aku kekahi o na kaulike, a maloko o na kaulike kekahi, aole nae he mau huina moe pu laua: penei UKE, KLO he mau huina kue mawaho a maloko laua; pela hoi AKU, ILK; EKL, OLH; HLI, LKA.

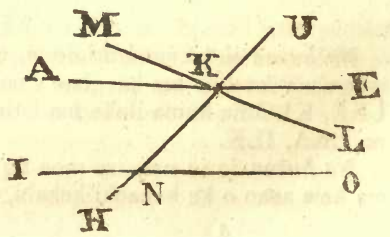
Manaopili 1. Ina i halawai ke kaha pololei UH me na kaha pololei elua AE, IO, e hoolilo ana i na huina io ia nei AKL, KLO i mau huina like; alaila ua kaulike ia mau kaha elua. E hui mai me keia mau huina, i ka huina LKE, alaila AKL + LKE = LKE + KLO; aka ua like AKL + LKE me na huinakupono elua (Manaohai 1.); nolaila KLO + LKE = elua huinakupono: nolaila ua kaulike AE, IO.

Manaopili 2. Ina i halawai ke kaha pololei UH me kekahi mau kaha pololei elua AE, IO, a ua like ka huina mawaho UKE me kona huina kue maloko KLO, alaila ua kaulike keia mau kaha elua. E hui mai me keia mau huina, i ka huina LKE, alaila, ua loaa na huina UKE + LKE = KLO + LKE: aka ua like UKE + LKE me na huinakupono elua; nolaila ua like KLO + LKE me na huinakupono elua: a nolaila hoi, ua kaulike na kaha AE, IO.

MANAOHAI XX.

Ina i halawai ke kaha pololei me na kaha pololei i kaulike elua, alaila ua like ka houluulu ana o na huina iloko ma kahi aoao, me na huina kupono elua.

I mau kaha kaulike AE a me IO, e halawaiia e ke kahaoki UH; alaila, ua like NKE + KNO me na huinakupono elua; a ua like hoi AKN + INK me na huinakupono elua.

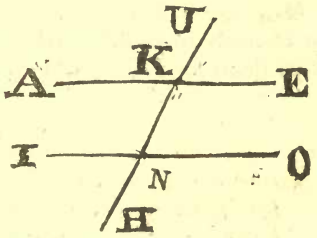


No ka mea, ina aole i like NKE + KNO me na huinakupono elua; e kaha i ke kaha MKL, i like KNO + NKL me na huinakupono elua; alaila ua kaulike ML a me IO (Manaohai XIX.), a malaila ua loaa na kaha elua KE, KL i kahaia ma ke kiko hookahi K e kaulike ana me ke kaha IO, he mea hiki ole ia (Ak. 12.); nolaila ua pili pu KL a me KE, a ua like NKE + KNO me na huinakupono elua. Pela no hoi, ua hiki ke hoomaopopoia mai, ua like NKA + INK me na huinakupono elua.

Manaopili 1. Ina he huinakupono NKE, alaila he huinakupono no hoi KNO; nolaila, *ina i kupono kekahi kaha pololei me kekahi kaha o na kaulike, ua kupono no hoi ia me kekahi.*

Manaopili 2. Ina i halawai kekahi kaha pololei me na kaha kaulike elua, ua like na huina io ia nei.

I mau kaulike AE, IO, a o UH ke kahaoki. O ka houluulu ana o na huina NKE + KNO ua like ia me na huinakupono elua, Aka ua like hoi ka houluulu ana o na huina NKE + NKA me na huinakupono elua (Manaohai 1). E lawe mai keia mau mea la i ka huina NKE, a ua koe ka huina KNO = NKA.



Pela ua hiki ke hoomaopopoia KNI = NKE.

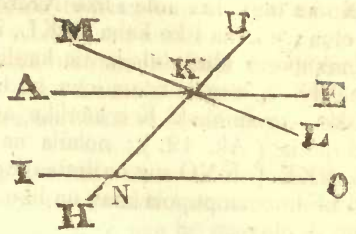
Manaopili 3. Ina i halawai kekahi kaha pololei me na kaha kaulike elua, ua like na huina kue mawaho a maloko. No ka mea, ua like ka houluulu ana NKE + KNO me na huinakupono elua. Aka ua like ka houluulu ana NKE + UKE me na huinakupono elua. E lawe i ka huiua NKE mai keia mau mea la, a ua koe UKE = KNO. Pela hoi, ua akaka AKU = INK.

Manaopili 4. O na huina ewalu i hanaia, ma ka halawai hio mai ana o ke kahaoki me na kaha kaulike elua; ua like pu na huina oi eha; a ua like pu na huina peleleu eha.

MANAOHAI XXI.

Ina i halawai kekahi kaha pololei me na kaha pololei elua e ae, a ua uuku iho ka houluulu ana o na huina iloko ma kahi aoao i na huinakupono elua, alaila e halawai auanei ia mau kaha elua ke hooneeia'ku la laua.

E halawai ke kaha UH me na kaha pololei elua IO a me LM, i uuku iho ka houluulu ana o na huina iloko ma kahi aoao LKN + KNO i na huinakupono elua, alaila e halawai na kaha ML, IO ke hooneeia laua.



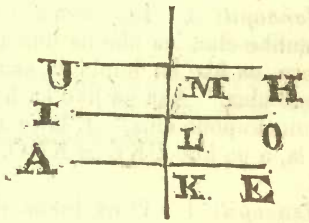
No ka mea, ina aole loa laua e halawai, ua kaulike laua (Hoakaka 12). Aka aole o laua kaulike, no ka mea, ina ua kaulike, ina ua like ka houluulu ana o na huina iloko LKM + KNO me na huinakupono elua (Manaohai XX.) aka ua uuku iho laua ma ka olelo mua: nolaila, aole i kaulike na kaha ML, IO; a nolaila hoi, e halawai auanei laua ke hooneeia'ku la.

Manaopili. Ua maopopo keia, e halawai na kaha ML, IO, ma ka aoao o ke kaha UH, i uuku ai ka houluulu ana o na huina iloko LKN + KNO i na huinakupono elua.

MANAOHAI XXII.

Ina he mau kaha pololei elua, a ua kaulike kela kaha pololei keia kaha pololei, me kekahi kaha pololei e ae; alaila, ua kaulike ia mau kaha pololei elua kekahi me kekahi.

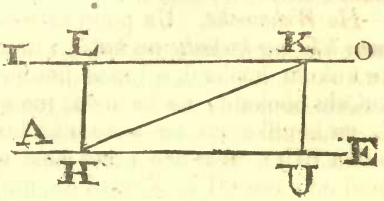
I kaulike na kaha pololei AE a me IO me ke kaha pololei UH, alaila, ua kaulike AE, IO kekahi me kekahi.



E kaha i ke kaha MLK e kupono ana ia UH a e oki ana ia IO a me AE. No ke kaulike ana o AE me UH, ua kupono ke kaha KM ia AE (Manaohai XX. Manaopili 1); a no ke kaulike ana o IO me UH, ua kupono KM ia IO. Nolaila ua kupono na kaha AE a me IO i ke kaha hookahi KM, a nolaila ua kaulike laua (Manaohai XVIII.).

MANAOHAI XXIII.

Ua like ka loa mawaena o na kaha kaulike elua ma na wahi a pau.

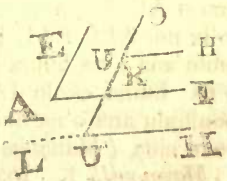


I mau kaha kaulike AE, IO: e koho wale i kekahi mau kiko U a me H, a e kaha i na kaha UK, HL e kupono ana ia AE: ua kupono no hoi laua ia IO (Manaohai XX. Manaopili 1.) ua like HL me UK.

E kaha i ke kaha HK: ma ke kaulike ana o AE, IO, o na huina KHU, HKL, he mau huina io ia nei laua, a nolaila ua like laua (Manaohai XX. Manaopili 2). A no ke kupono ana o na kaha UK, HL i ke kaha hookahi AE, ua kaulike laua (Manaohai XVIII). a no ke kaulike ana o na kaha UK, HL, o na huina HKU, KHL, he mau huina io ia nei laua, a nolaila ua like laua. Nolaila iloko o na huinakolu UHK, HKL, ua like na huina elua a me ka aoao mawaena o kekahi huinakolu, me na huina elua a me ka aoao mawaena o kekahi; nolaila, ua like keia mau huinakolu (Manaohai VI): nolaila ua like ka aoao UK, o ka loa mawaena o na kaulike AE, IO mai ke kiko U, me ka aoao HL, o ka loa mawaena o na kaulike AE, IO mai ke kiko H.

MANAOHAI XXIV.

Ina he mau huina elua, a ua kaulike na aoao o kekahi me na aoao o kekahi, a ua moe like na kukulu no hoi; alaila ua like ia mau huina elua.



I mau huina EAI, OUH, e kaulike ana EA me OU, a e kaulike ana AI me UH; alaila ua like ka huina EAI me ka huina OUH.

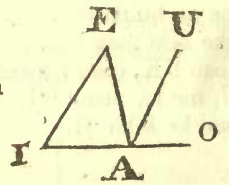
No ka mea, e hoonee i ke kaha OU a halawai pu ia me AI ma ke kiko K. Alaila, no ke kaulike ana o UH me KI ua like ka huina OUH me ka huina OKI (Manaohai XX. Manaopili 3.) a no ke kaulike ana o OK me EA, ua like ka huina OKI me ka huina EAI; nolaila ua like ka huina OUH me ka huina EAI.

He Wehewehe. Ua pono ka olelo ma keia manaohai "*a ua moe like na kukulu no hoi*"; i moe na aoao UH a me AI ma ke kukulu hookahi, a i moe hoi na aoao AE a me UO ma ke kukulu hookahi; no ka mea, ina i hooneeia ka aoao HU a ia L, ua kaulike no na aoao o ka huina EAI me na aoao o ka huina LUO, aole nae i like keia mau huina. Ua like no ka houluulu ana OUL + EAI me na huina kupono elua. No ka mea ua like OUH + OUL me na huinakupono elua (Manaohai 1): aka ua like OUL me EAI; nolaila ua like OUK + EAI me na huinakupono elua.

MANAOHAI XXV.

Ua like ka houluulu ana o na huina ekolu, o na huinakolu a pau loa, me na huinakupono elua.

I huinakolu AEI, ua like na huina I + A + E me na huinakupono elua.



No ka mea, e hoonee i ka aoao IA a ia O, ma ke kiko A e kaha i ke kaha AU e kaulike ana me IE. Alaila, no ekkaulike ana o AU me IE, a ua okiia laua e ke kaha IAO, ua like ka huina mawaho UAO me kona huina kue maloko AIE (Manaohai XX. Manaopili 3): pela no hoi, no ke kaulike ana o AU, IE, a ua okiia laua e ke kaha EA, ua like na huina io ia nei AEI, EAU kekahi me kekahi; nolaila ua like ka houluulu ana o na huina ekolu o ka huinakolu me ka houluulu ana o na huina ekolu IAE + EAU + UAO: nolaila ua like ka houluulu ana o na huina ekolu o ka huinakolu me na huinakupono elua (Manaohai I.)

Manaopili 1. Ina i haawiia na huina elua, a o ka houluulu ana paha o na huina elua o kekahi huinakolu, ua loaa ke kolu ma ka unuhi ana i keia houluulu ana noloko mai o na huinakupono elua.

Manaopili 2. Ina ua like na huina elua o kekahi huinakolu, me na huina elua o kekahi huinakolu, kekahi me kekahi; alaila ua like ke kolu o na huina o kekahi me ke kolu o kekahi, a ua *huinalike* ia mau huinakolu kekahi me kekahi.

Manaopili 3. Iloko o ka huinakolu, ua hiki ka huinakupono hookahi wale no; no ka mea, ina ua loaa elua, alaila o ke kolu o na huina ua ole loa ia.

Manaopili 4. Ua like ka houluulu ana o na huina oi, o na huinakolu kupono a pau, me ka huinakupono hookahi.

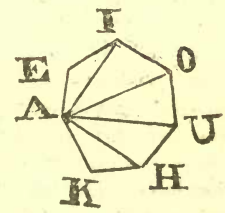
Manaopili 5. No ka huinalike ana o na huinakolulike (Manaohai XI. Manaopili.), nolaila ua like kela huina keia huina me na hapakolu elua o ka huinakupono: a ina i kapaia ka huinakupono 1, alaila ua kapaia kekahi huina o ka huinakolulike $\frac{2}{3}$.

Manaopili 6. Iloko o na huinakolu a pau AEI, ua like ka huina mawaho EAO me ka houluulu ana o na huina koe elua maloko AIE + AEI. No ka mea ma ke kaulike ana o AU me IE, ua like ka huina EAU, kahi apana o ka huina EAO, me ka huina E; a ua like ka apana koe UAO me ka huina I.

MANAOHAI XXVI.

Ua like ka houluulu ana o na huina a pau iloko o kekahi huinalehulehu, me na huinakupono i helu palua ia i na aoao o ke kii, ke lawe e ia'ku na aoao elua.

I huinalehulehu AEIOUHK. Mai ke kihi o kekahi huina A, e kaha i na kahakapakahi AI, AO, AU, AH, a pili i na kihi o na huina kue. Ina ehiku aoao o ka huinalehulehu, ua akaka, ua maheleia oia i na huinakolu elima; a ina ewalu ona aoao, ua maheleia oia i na huinakolu eono; ina he umi aoao ona, ua maheleia oia i mau huinakolu ewalu. Pela no na huinalehulehu a pau, i maheleia i mau huinakolu, elua ke emi ana o ka lehulehu o na huinakolu, i ka lehulehu o na aoao o ka huinalehulehu: no ka mea, o A ke kihi o keia mau huinakolu a pau, a o ko lakou mau wawae, oia no na aoao o ka huinalehulehu, koe nae na aoao elua e pili ana i ka huina A. Ua maopopo hoi, ua like



ka houluulu ana o na huina a pau o keia mau huinakolu a pau, me na huina a pau iloko o ka huinalehulehu: a ua like ka houluulu ana o na huina a pau o kela huinakolu keia huinakolu me na huinakupono elua: nolaila, ua like ka houluulu ana o na huina a pau iloko o ka huinalehulehu, me na huinakupono i helu palua ia no kela aoao keia aoao o ke kii, ke lawe e ia'ku na aoao elua.

Manaopili 1. Ua like ka houluulu ana o na huina o ka huinaha, me na huinakupono elua i hoonuiia e 4 — 2, oia no na huinakupono eha: nolaila, ina he mau huinalike na huina o ka huinaha, alaila he mau huinakupono lakou: he mea keia e hoapono ana mai i ka Hoakaka 17, e i mai ana, no ka huinahalike, he mau huinakupono eha kona.

Manaopili 2. Ua like ka houluulu ana o na huina a pau o ka huinalima, me na huinakupono elua i hoonuiia, e 5 — 2, oia no na huinakupono eono: nolaila, ina he huinalike ka huinalima, ua like kekahi huina ona me ka hapalima o na huinakupono eono, oia no $\frac{5}{6}$ o ka huinakupono hookahi.

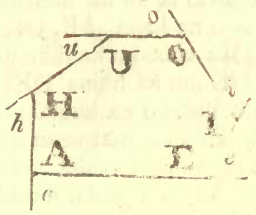
Manaopili 3. Ua like ka houluulu ana o na huina a pau o ka huinaono me na huinakupono 2 i hoonuiia e 6 — 2, oia no na huinakupono ewalu: nolaila, ina he huinalike ka huinaono, ua like kekahi huina ona me ka hapaono o na huinakupono ewalu, oia no $\frac{3}{6} = \frac{4}{3}$ o ka huinakupono hookahi.

He Wehewehe. Ina i hoopiliia keia manaohai i ka huinalehulehu, nona kekahi huina *komo hou* (me ka huina A), he pono ke manaoia ka huina komo hou, he huina nui aku ia i na huinakupono elua. Aka, i ole e hihia, e hana kakou ma keia palapala, ma keia hope aku, ma na huinalehulehu, me na huina *lele* wale no (me ka huina E); ua pono ke kapaia mai ka huinalehulehu, mea huina lele wale no, i *huinalehulehu kihi mawaho.* Ua hiki ke kaha pololei ke oki i ke anapuni o ka huinalehulehu kihi mawaho, ma na wahi elua wale no.

MANAOHAI XXVII.

Ina i hooneeia na aoao o ka huinalehulehu, a like ke kukulu o ka nee ana; alaila, ua like ka houluulu ana o na huina mawaho a pau, me na huinakupono eha.

E hoonee i na aoao o ka huinalehulehu AEIOUH, a like ke kukulu o ka nee ana, alaila ua like ka houluulu ana o na huina mawaho $a+e+i+o+u+h$ me na huinakupono eha.



No ka mea ua like ka houluulu ana o kekahi huina maloko a me kona huina mawaho, (me A + a) me na huinakupono elua (Manaohai 1). Aka, ua like ka lehulehu o na huina mawaho, me ka lehulehu o na huina maloko; a ua like hoi me ka lehulehu o na aoao o ka huinalehulehu: nolaila ua like ka houluulu ana o na huina maloko a pau, a me na huina mawaho a pau, me na huinakupono elua i hoonuiia e ka helu'na o na aoao o ka huinalehulehu.

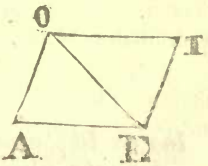
Eia hoi, ua like ka houluulu ana o na huina a pau maloko, me na huinakupono i paluaia i na aoao o ka huinalehulehu, ke lawe e ia na aoao elua (Manaohai XXVI.); oia no keia, ua like ka houluulu ana o na huina a pau maloko i huipuia'ku me na huinakupono eha, me na huinakupono i helupaluaia i na aoao a pau.

Nolaila ua like ka houluulu ana o na huina a pau maloko + aha huinakupono, me ka houluulu ana o na huina a pau maloko a me na huina a pau mawaho: e hoolawe i na huina a pau maloko mai keia mau mea aku la; a ua koe na huina a pau mawaho = me na huinakupono eha.

MANAOHAI XXVIII.

Iloko o na huinahakaulike a pau, ua like na huina kue, a me na aoao kue.

I huinahakaulike AEIO; ua like ka aoao AE me OI, AO = EI; a o ka huina A = I, AOI = AEI.



No ka mea, e kaha i ke kahakapakahi EO. O ka aoao EO

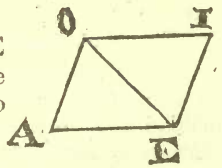
he aoao ia no na huinakolu elua AEO, EOI: a no ke kaulike ana o na kaha AE, OI, ua like ka huina AEO me ka huina EOI; a no ke kaulike ana o na aoao AO, EI, ua like ka huina AOE me ka huina OEI (Manaohai XX. Manaopili 2); nolaila iloko o na huinakolu AOE, OIE, ua like na huina elua a me ka aoao mawaena o kekahi me na huina elua a me ka aoao mawaena o kekahi, nolaila ua like ia mau huinakolu (Manaohai VI): nolaila ua like ka aoao AE e kue ana i ka huina AOE me OI e kue ana i ka huina like OEI: a ua like hoi AO me EI: nolaila ua like na aoao kue o ka huinahakaulike.

Eia hoi, no ka like ana o na huinakolu, ua like ka huina A me ka huina I. A o ka huina AOI, o ka houluulu ana ia o na huina AOE + EOI, ua like ia me AEI o ka houluulu ana ia o na huina AEO + OEI. Nolaila ua like na huina kue o ka huinahakaulike.

Manaopili, Ua like na kahakaulike AE, OI e moe ana mawaena o na kahakaulike e ae AO, EI. A ke hoomahele nei ke kahakapakahi i ka huinahakaulike, i elua huinakolu like kekahi me kekahi.

MANAOHAI XXIX.

Ina ua like na aoao kue o kahi huinaha, kekahi me kekahi, alaila ua kaulike ke kii.



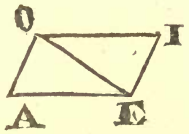
I huinaha AEIO, i like hoi ka aoao AE me OI; a o AO = EI; alaila ua kaulike AE me OI, a ua kaulike AO me EI; a o ke kii, he huinahakaulike ia.

E kaha i ke kahakapakahi EO, Ua like na aoao a pau o ka huinakolu AEO, me na aoao a pau o ka huinakolu EOI, nolaila ua like laua; a ua like ka huina AOE e kue ana ia AE, me ka huina IEO e kue ana ia OI (Manaohai X.): nolaila ua kaulike ka aoao AE me OI (Manaohai XIX. Manaopili 1.) Pela no hoi, ua kaulike AO me EI; nolaila he huinahakaulike ka huinaha AEIO.

MANAOHAI XXX.

Ina ua like, a ua kaulike hoi na aoao kue elua o kekahi huinaha, alaila ua like a ua kaulike hoi na aoao elua i koe, a he huinahakaulike ke kii.

I huinaha AEIO, I like a i kaulike hoi ka aoao AE me ka aoao OI: alaila ua like, a ua kaulike hoi ka aoao AO me ka aoao EI, a he huinahakaulike ka huinaha AEIO.

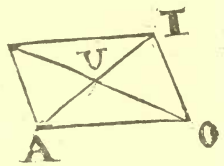


No ka mea, e kaha i ke kahakapakahi OE, alaila no ke kaulike ana o AE me OI ua like na huina io ia nei AEO, EOI (Manaohai XX. Manaopili 2); eia hoi, o ka aoao OE, he aoao ia o na huinakolu elua AOE, EOI, a o ka aoao AE = OI; nolaila ua like ka huinakolu AOE me ka huinakolu OEI (Manaohai V.) nolaila ua like ka aoao AO me ka aoao EI, a o ka huina AOE = OEI, a nolaila ua kaulike AO me EI; nolaila, he huinahakaulike ke kii AEIO.

MANAOHAI XXXI.

O na kahakapakahi o ka huinahakaulike, ua mahele alike alike laua kekahi i kekahi.

I huinahakaulike AEIO: AI, EO kona mau kahakapakahi, e oki ana kekahi i kekahi ma ke kiko U; alaila ua like AU me UI; a EU = UO



Iloko o na huinakolu AUO, EUI, o ka aoao AO = EI (Manaohai XXVIII.), a o ka huina AOU = IEU, a o ka huina OAU = EIU (Manaohai XX. Manaopili 2.); nolaila ua like ia mau huinakolu (Manaohai VI.); nolaila ua like ka aoao AU e kue ana i ka huina AOU, me ka aoao UI e kue ana i ka huina like UEI: pela hoi ua like EU me UO.

He Wehewehe. Iloko o ka huinahahio, ua like ka aoao AE me ka aoao EI, a o na aoao o ka huinakolu AUE = na aoao o ka huinakolu EUI, nolaila ua like keia mau huinakolu; nolaila ua like ka huina AUE me ka huina EUI. Nolaila ua oki kupono na kahakapakahi elua o ka huinahahio kekahi i kekahi.

BUKE II.

No na ratio a me na like ana.

He mau mea Hoakaka.

1. *Ratio*, oia ka puuhapa, ke puunaueia kekahi kuaniti e kekahi kuaniti ano like e ae. Penei, ina he mau kuaniti ano like A a me E, ua hoikeia ka ratio o A ia E penei $\frac{E}{A}$

2. Ina he mau kuaniti eha A, E, I, O, a ua like $\frac{E}{A}$ me $\frac{O}{I}$, alaila ua like ka ratio o A ia E me ka ratio o I ia O; a ua oleloia ia mau kuaniti eha, he mau kuaniti *ratio like.* Penei i hoikeia ka like ana o ka ratio o A ia E me ka ratio o I ia O, A : E :: I : O, a ua heluheluia penei, me ka like ana o A ia E, pela no I ia O.

Ua kapaia na kuaniti i hoohalikeia, na *hua* o ka ratio like. O ka hua mua a me ka hua hope, oia na *hua welau elua*; o ka lua o na hua a me ke kolu, oia na *hua waena elua.*

3. O na kuaniti ratio like elua, ua kapaia ka mua a me ke kolu *o na hikimua*; a ua kapaia ka'lua a me ka'ha *o na ukali.*

4. Ua ratio like na kuaniti ekolu, ke like ka ratio o ka mua i ka'lua, me ka ratio o ka'lua i ke 'kolu ; alaila, o ka huawaena, he ratio like waena ia o kela mau hua elua.

5. Ua oleloia na kuaniti, he ratio like *huli mai,* ke hooliloia na ukali i hikimua, a o na hikimua i ukali.

6. Ua oleloia na kuaniti, he ratio like *io ia nei,* ke hoohalikeia kekahi hikimua me kekahi hikimua, a o kekahi ukali me kekahi ukali.

7. Ua oleloia na kuaniti, he ratio like *huiia,* ke hoohalikeia ka houluulu ana o ka hikimua a me ka ukali, me ka hikimua paha, me ka ukali paha.

8. Ua oleloia na kuaniti, he ratio puunaueia, ke hoohalikeia ka like ole o ka hikimua a me ka ukali, me ka hikimua paha, me ka ukali paha.

9. O *na hoonuilike* o na kuaniti elua, oia ka mea i loaa ma ka hoonui ana ia mau kuaniti e ka helu hookahi: penei, $m \times A$, $m \times E$ he mau *hoonuilike* laua o na kuaniti A a me E, no ka mea ua hoonuiia laua e ka helu hookahi *m*.

10. Ua oleloia na kuaniti elua A me E, he *ratio like aku like mai* ko laua, ke mahuahua kekahi ma ka ratio i emi iho ai kekahi.

MANAOHAI I.

Ina ua ratio like na kuaniti eha, alaila, ua like ka hoonui ana o na welau elua me ka hoonui ana o na waena elua.

I mau kuaniti ratio like eha, A, E, I, O, A : E :: I : O; alaila $A \times O = E \times I$; no ka mea, no ka ratio like ana $\frac{E}{A} = \frac{O}{I}$, nolaila $E = A \times \frac{O}{I}$, a o $E \times I = A \times O$.

Manaopili. Ina ua ratio like na kuaniti ekolu (Hoak. 4), alaila, ua like ka hoonui ana o na welau me ke kuea o ka waena.

MANAOHAI II.

Ina ua like ka hoonui ana o na kuaniti elua, me ka hoonui ana o na kuaniti elua e ae: alaila, he mau welau kekahi mau kuaniti elua, a he mau waena kekahi mau kuaniti elua o ka ratio like.

I like $A \times E = I \times O$; alaila, A : I :: O : E; no ka mea, ina aole i like ka ratio o O ia E me ka ratio o A ia I, i like ka ratio o O ia M me ka ratio o A ia E, oia no A : I :: O : M, alaila $A \times M = I \times O$ (Manaohai 1); nolaila $M = \frac{I \times O}{A}$; aka $E = \frac{I \times O}{A}$; nolaila M = E a ua ratio like ia mau kuaniti eha; oia no keia A : I :: O : E.

MANAOHAI III.

Ina ua ratio like na kuaniti eha; alaila, ua ratio like io ia nei lakou.

I ratio like A, E, I, O.

A : E :: I : O; alaila A : I :: E : O. No ka ratio like A : E :: I : O, ua like $A \times O = E \times I$; nolaila, ua hiki ke hooliloia A a me O i mau welau, a o E a me I i mau waena o ka ratio like (Manaohai II.) nolaila A : I :: E : O.

MANAOHAI IV.

Ina he mau kuaniti ratio like eha a he mau kuaniti ratio like e ae eha, a ua like na hikimua o kela mau kuaniti me na hikimua o keia mau kuaniti, alaila ua ratio like na ukali.

I mau kuaniti ratio like eha.

A : E : : I : O

a me A : U : : I : H

alaila E : O : : U : H no ka mea ma ka ratio like io ia nei. A : I : : E : O, $\frac{I}{A} = \frac{O}{E}$

a A : I : : U : H, $\frac{I}{A} = \frac{H}{U}$

nolaila $\frac{O}{E}, = \frac{H}{U}$, oia no keia E : O : : U : H

Manaopili, Ina elua poe kuaniti ratio like, a ua like kekahi hikimua a me kekahi ukali, o ka poe mua, me kekahi hikimua a me kekahi ukali o ka poe lua; alaila, ua ratio like na hua i koe.

MANAOHAI V.

Ina ua ratio like na kuaniti eha, alaila ua ratio like huli mai lakou.

I mau kuaniti ratio like eha.

A : E : : I : O; alaila
E : A : : O : I

No ka mea, ma ka ratio like mua ua loaa

$A \times O = E \times I$; oia no $E \times I = A \times O$.

Aka o na hoonui $E \times I$ a me $A \times O$, o na hoonui ia o na welau a me na waena o na kuaniti aha E, A, O, I; a no ka like ana o keia mau hoonui,

E : A : : O : I (Manaohai II.).

MANAOHAI VI.

Ina ua ratio like na kuaniti eha, alaila, ua ratio like huiia a ua ratio like puunaueia lakou.

I mau kuaniti ratio like eha

$$A : E :: I : O \text{ alaila}$$
$$A \pm E : A :: I \pm O : I$$

No ka mea, ma ka ratio like mua, ua loaa

$$A \times O = E \times I, \text{ oia no } E \times I = A \times O$$

E houluulu pu i keia mau like hope me A.I e hoolawe hoi ia ia noloko mai o A.I, a ua loaa

$$A.I \pm E \times I = A.I \pm A \times O$$
$$\text{oia no} \quad (A \pm E) \times I = (I \pm O) \times A$$

Aka ua hiki ke hooliloia $(A \pm E)$ a me I i mau welau, a o $(I \pm O)$ a me A i mau waena o ka ratio like (Manaohai II), nolaila

$$A \pm E : A :: I \pm O : I.$$

MANAOHAI VII.

Ua like ka ratio o na hoonuilike o kekahi mau kuaniti, me ka ratio o ia mau kuaniti iho.

I mau kuaniti A a me E, a o *m* kekahi helu okoa ; *m*.A, *m*.E oia na hoonuilike o na kuaniti A a me E, alaila

$$m.A : m.E :: A : E \text{ no ka mea}$$

$m.A \times E = m.E \times A$ no ka mea, *hookahi* no na kuaniti ma kela aoao, a ma keia aoao o ka like ana ; a nolaila ua ratio like lakou (Manaohai II), oia $m.A : m.E :: A : E$.

MANAOHAI VIII.

Iloko o na kuaniti ratio like eha, ina i laweia kekahi mau hoonuilike o na hikimua, a i mau hoonuilike hoi o na ukali, alaila ua ratio like na kuaniti eha i loaa mai ilaila.

I mau kuaniti ratio like eha A, E, I, O, I mau helu hoi *m* a me *n*, alaila

$$m.A : n.E :: m.I : n.O$$

No ka mea, no ka ratio like A : E : : I : O ua loaa

$A \times O = E \times I$, nolaila, i hoonuiia na aoao o keia like ana e $m \times n$ ua loaa

$m.A \times n.O = m.E \times n.I$. Aka, ua hiki ke hooliloia $m.A$ me $n.O$ i mau welau, a o $m.E$ a me $n.I$ i mau waena o ka ratio like; nolaila $m.A : n.E : : m.I : n.O$.

MANAOHAI IX.

Ilako o na knaniti ratiolike eha, ina i hoomahuahua, a i hoemiia paha na ukali elua, e kekahi mau kuaniti ratio like me ka ratio o na hikimua; alaila ua ratio like na kuaniti i loaa mai me na hikimua.

I mau kuaniti ratio like eha

$$A : E : : I : O$$

I mau kuaniti hoi ratio like me na hikimua, m a me n :

$$A : I : : m : n$$

alaila, $A : I : : E \pm m : O \pm n$

No ka ratio like ana $A : E : : I : O$, $A \times O = E \times I$

no ka ratio like ana $A : I : : m : n$, $A \times n = I \times m$

Nolaila $A \times O \pm A \times n = E \times I \pm I \times m$

oia no keia $A \times (O \pm n) = I \times (E \pm m)$

Nolaila $A : I : : E \pm m : O \pm n$ (Manaohai II.).

MANAOHAI X.

Ina ua ratio like kekahi mau kuaniti, alaila, ua ratio like kekahi hikimua i kona ukali, me ka houluulu ana o na hikimua a pau i ka hooululu ana o na ukali a pau.

I ratio like na kuaniti $A : E : : I : O : : H : K$ alaila

$A : E : : \overline{A+I+H} : \overline{E+O+K}$

Ma ka ratio like $A : E : : I : O$, ua loaa $A \times O = E \times I$

Ma ka ratio like $A : E : : H : K$, ua loaa $A \times K = E \times H$

E houluulu pu me ia mau like ana i keia $A \times E = A \times E$

A ua loaa $A.E + A.O + A.K = A.E + E.I + E.H$

oia no keia $A \times (E + O + K) = E \times (A + I + H)$

Nolaila $A : E : : \overline{A+I+H} : : \overline{E+O+K}$.

MANAOHAI XI.

Ina i hoomahuahuaia, a e hoemiia paha na kuaniti elua, ma na hapa like o kekahi a o kekahi; alaila ua like ka ratio o na kuaniti i loaa me ka ratio o ia mau kuaniti la.

I mau kuaniti elua A a me E, a o na hapa like o laua $\frac{A}{m}$ a me $\frac{E}{m}$ alaila $A : E :: A \pm \frac{A}{m} : E \pm \frac{E}{m}$

No ka mea, ua maopopo keia $A \times (E \pm \frac{E}{m}) = E \times (A \pm \frac{A}{m})$ no ka mea, ua like kela mea keia mea o laua me $A.E \pm \frac{AE}{m}$. Nolaila ua ratio like ia mau kuaniti eha (Manaohai II.).

MANAOHAI XII.

Ina i ratio like na kuaniti eha, alaila ua ratio like no hoi ko lakou mau kuea, a me ko lakou mau kuba.

I mau kuaniti ratio like eha,

$A : E :: I : O$; alaila
$A^2 : E^2 :: I^2 : O^2$
a me $A^3 : E^3 :: I^3 : O^3$

No ka mea $A \times O = E \times I$ ma kal ike ana $A : E :: I : O$ E kuea i na aoao o keia like ana, a ua loaa

$A^2 \times O^2 = E^2 \times I^2$

A kuba hoi, a ua loaa $A^3 \times O^3 = E^3 \times I^3$

Nolaila $A^2 : E^2 :: I^2 : O^2$
a $A^3 : E^3 :: I^3 : O^3$

Manaopili. Pela no hoi e hiki ai ke hoakakaia, ua ratio like na papa like a me na kumukaha like o na kuaniti ratio like.

MANAOHAI XIII.

Ina paha elua poe kuaniti ratio like; alaila ua ratio like ka mea i loaa ma ka hoonui ana i na hua ku like.

Eia na kuaniti ratio like,

$$A : E :: I : O$$
$$H : K :: L : U$$
$$A \times H : E \times K :: I \times L : O \times U$$

No ka mea, $A \times O = E \times I$

a me $H \times M = K \times L$, ua loaa ilaila

$$A \times O \times H \times M = E \times I \times K \times L$$

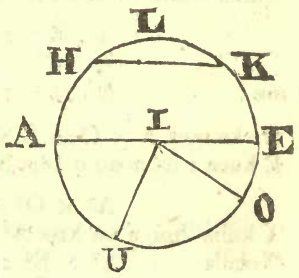
oia no keia $\overline{A \times H} \times \overline{O \times M} = \overline{E \times K} \times \overline{I \times L}$

Nolaila, $\overline{A \times H} : \overline{E \times K} :: \overline{I \times L} : \overline{O \times M}$

BUKE III.

O KA POAI, A ME KE ANA ANA I NA HUINA.

He mau hoakaka.



1. O ka *poai*, he waena ia i hoopuniia e ke kaha kekee; a ua kapaia ua kaei kekee la, o ke *anapuni*, a ua like ka loa mai keia kiko kela kiko o ke anapuni a i kekahi kiko mawaena, a ua kapaia hoi ua kiko la, ke *kiko waena*.

2. O ka *hanai*, oia ke kaha pololei e moe ana ma ke kikowaena a hiki i ke anapuni, me IA, IU, IO; oia ka wa i weheia'e ka upa i ke kaha ana i ka poai; o ka hapalua ia o ke anawaena. Malaila ua akaka, ua like na hanai a pau o kekahi poai; a ua like hoi na anawaena a pau o kekahi poai.

3. O ka *pio*, oia ka hapa o ke anapuni o ka poai; me HLK.

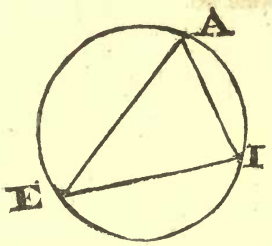
O ke *kaula* o ka pio, oia ke kaha pololei e hoopa ana i kela poo i keia poo o ka pio, me HK, oia ka i mahelelua i ka poai i elua apana like ole, ua kapaia hoi ua mau apana la, he mau *apanapoai*.

4. O ka *apana*, oia no ka ili mawaena o kekahi pio a me kona kaula, me HKL.

5. O ka *apana hanai*, oia no ka ili mawaena o na hanai elua a me ka pio, me IUO.

6. Ua oleloia ke *kaha pololei, ua kaha lokoia oia iloko o ka poai*, ke kau kona mau welau ma ke anapuni me AE.

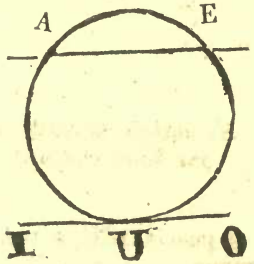
O ka *huina kahalokoia*, oia no ka huina, e like me EAI, i kau kona kihi ma ke anapuni a he mau kaula kona mau aoao.



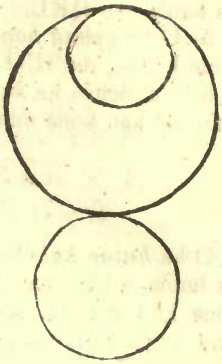
O ka *huinakolu kahalokoia*, oia no ka huinakolu, e like me AEI, i kau na kihi o kona mau huina ma ke anapuni.

A o na kii a pau loa; *o ke kii kahalokoia*, oia no ke kii i kau ke kihi o kona mau huina a pau ma ke anapuni. A ua oleloia ke anapuni, ua *kaha poai* oia i ua kii la.

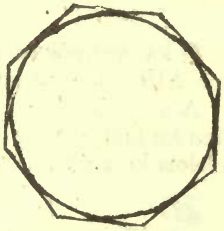
7. He *kahaoki* ke kaha i halawai me ke anapuni ma na kiko elua, a ua moe kauwahi maloko o ka poai, a mawaho kau wahi, e like me AE.



8. He *kahapili* ke kaha i halawai me ke anapuni ma ke kiko hookahi wale no, e like me IO. O ke kiko U, kahi i halawai ai ke kahapili me ke anapuni, ua kapaia oia *o ke kiko o ka pili*.



Pela no hoi, ua *pili* na anapuni elua, ke halawai laua ma ke kiko hookahi wale no.



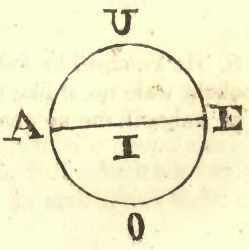
9. Ua oleloia ka huinalehulehu, *ua kahawahoia* oia o ka poai, ina he mau kahapili kona mau aoao a pau. A ilaila, ua oleloia ka poai, ua *kahalokoia* oia o ka huinalehulehu.

MANAOHAI I.

Ke mahele la alike alike na anawaena a pau i ka poai a me kona anapuni.

I poai AOEU, a o AE kona anawaena.

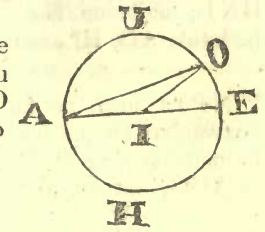
Ina i hoopiliia ke kii AUE me ke kii AOE e ku paa ana ka aoao AE, alaila ua pili like laua. No ka mea, ina aole laua i pili loa, ua loaa na kiko o kekahi i like ole ka loa mai ke kikowaena mai, he mea ku pono ole i ka olelo hoakaka i ka poai.



MANAOHAI II.

Ua uuku iho na kaula a pau i ke anawaena.

E kau mai ia AO kekahi kaula. A e kaha i na hanai IA, IE i kona mau welau. Alaila ua loaa AO ∠ AI + IO (Buke I. Manaohai VII.*); oia no AO ∠ AE.



Manaopili. Nolaila, o ke anawaena ke kaha i oi aku kona loa i ko na kaha a pau i hiki ke kahalokoia o ka poai.

MANAOHAI III.

Ua hiki ke kaha pololei ke halawai me ke anapuni o ka poai ma na kiko elua wale no.

No ka mea, ina ua hiki ia ia ke halawai me ke anapuni ma na kiko ekolu paha, alaila, ua like ka loa mai ia mau kiko la a i ke kikowaena; a malaila ua loaa na kaha pololei ekolu i like ko lakou loa, i kahaia mai ke kiko hookahi, a i ke kaha hookahi, o ka mea hiki ole no ia (Buke I. Manaohai XV. Manaopili 2,).

MANAOHAI IV.

Iloko o kekahi poai, a iloko o na poai like no hoi, ua hoopaaia na poo o na pio like e na kaula like; a ua hoopaa no hoi na kaula like i na poo o na pio like.

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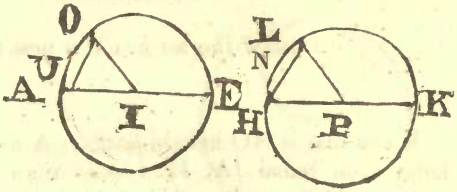
* E nana mai. Ina ma kekahi manaohai i kuhikuhiia kekahi o ia Buke iho no, alaila o ka helu o ka Manaohai wale no ka mea i haawiia, aka ina ma kekahi Buke e ae ka Manaohai i kuhikuhiia, alaila ua haawi pu ia no hoi ka helu o ka Buke.

Ina ua like na hanai AI, HP, a ina ua like hoi na pio AUO, HNL; alaila ua like na kaula AO, HL.



No ka mea, no ka like ana o ke anawaena AE me ke anawaena HK, ua hiki ke hoopili i ka hapalua poai AUOE me ka hapalua poai HNLK a pili loa laua, a ua pili like ke anapuni AUOE me ke anapuni HNLK. Aka ua like ka pio AUO me ka pio HNL; nolaila ua kau ke kiko O maluna o ke kiko L; a nolaila ua like ke kaula AO me ke kaula HL.

Eia hoi, ina ua like na hanai AI, HP, a ina ua like hoi ke kaula AO me ke kaula HL, alaila, ua like ka pio AUO me ka pio HNL.

No ka mea, ina i kahaia na hanai IO a me PL, alaila ua like na aoao o ka huinakolu AIO me na aoao o ka huinakolu HPL, kekahi me kekahi, penei AI = HP, IO = PL, AO = HL; nolaila, ua like ia mau huinakolu; a nolaila ua like ka huina AIO me ka huina HPL (Buke I. Manaohai X.). E hoopili i ka hapaluapoai AOE maluna o kona like HLK, a no ka like ana o ka huina AIO me ka huina HPL, ua kau maopopo mai no ka hanai IO maluna o ka hanai PL, a ua pili ke kiko O me ke kiko L; nolaila, ua like ka pio AUO me ka pio HNL.

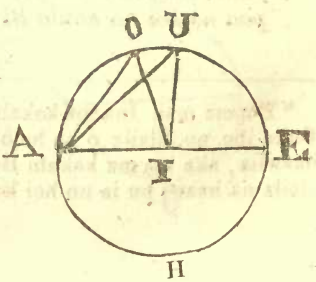
MANAOHAI V.

Iloko o kekahi poai, a iloko o na poai like no hoi, ua hoopaaia na poo o ka pio nui ae e ke kaula nui ae; a o ke kaula nui ae, ua hoopaa no oia i na poo o ka pio nui ae.

I nui ae ka pio AU i ka pio AO; alaila ua nui ae ke kaula AU i ke kaula AO.

No ka mea, e kaha i na hanai IO, IU.

Ua like na aoao elua AI, IU o ka huinakolu AIU, me na aoao elua AI, IO o ka huinakolu AIO: a ua nui aku ka huina AIU i ka huina AIO: nolaila, o ka aoao ekolu AU, ua nui aku



ia i ka aoao ekolu AO (Buke I. Manaohai IX.); nolaila, ua nui ae ke kaula, ka i hoopaa i na poo o ka pio nui ae.

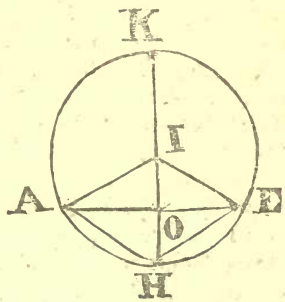
Eia hoi, ina ua nui aku ke kaula AU i ke kaula AO, alaila, i ka hoopili ana ia mau huinakolu, ua loaa ka huina AIU nui aku i ka huina AIO (Buke I. Manaohai IX. Wehewehe): nolaila, ua nui aku ka pio AU i ka pio AO (Akioma 8.).

He Wehewehe. O neia mau pio i hanaia, ua uuku iho laua i ka hapalua o ke anapuni. Ina ua nui aku laua, alaila ua ano okoa, no ka mea, ma ka nui ana ae o ka pio ua emi mai ke kaula: a ma ka nui ana ae o ke kaula ua emi mai ka pio. Penei, ua nui aku ka pio AHEO i ka pio AHEU, a ua uuku AO ke kaula o ka mua, ia AU ke kaula o ka lua.

MANAOHAI YI.

O ka hanai i kupono i kekahi kaula, ua mahele like oia i ua kaula la, a ua mahele like hoi oia i ka pio i hoopaaia kona mau poo e ua kaula nei.

I kaula AE, a o IH ka hanai i kupono ia ia: alaila AO = OE, a o ka pio AH = ka pio HE.



No ka mea, e kaha i na hanai IA, IE, alaila iloko o na huinakolu kupono elua IAO, IOE ua loaa ka aoao IA = ka aoao IE, a o ka aoao IO no ia mau huinakolu a elua, nolaila ua like AO me OE (Buke I. Manaohai XVII.).

Eia hoi, no ka like ana o AO, OE, nolaila he kaha kupono o IH i kukuluia ma ke kikowaena o AE; nolaila ua loa like na kiko a pau o keia kaha kupono mai na welau A a me E mai, (Buke I. Manaohai XVI.). E a kekahi kiko o keia kaha o H: nolaila ua like AH me HE. Aka ina ua like ke kaula AH me ke kaula HE, alaila ua like ka pio AH me ka pio HE (Manaohai IV.); nolaila o ka hanai IH kupono i ke kaula AE, ua mahelelike oia i ka pio i hoopaaia kona mau poo e ua kaula nei.

He Wehewehe. O ke kikowaena I, a o ke kiko O mawaenakonu o ke kaula AE, a o ke kiko H mawaenakonu o ka pio

AHE i hoopaaia kona mau poo e ke kaula AE; ma ke kaha hookahi i kupono i ke kaula keia mau kiko ekolu. Aka ina i loaa na kiko elua ua maopopo kahi e kau ai ke kaha pololei; nolaila, o ke kaha pololei i pili i na kiko elua o keia mau kiko i oleloia, ua pili no hoi i ke kolu, a ua kupono no ia i ke kaula.

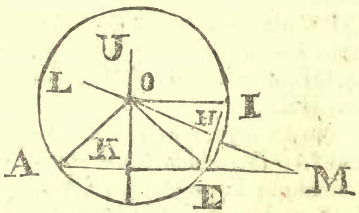
Ua akaka no hoi o keia, *o ke kaha kupono i kukuluia mawaenakonu o ke kaula, ua holo no oia ma ke kikowaena o ka poai, a i ke kiko hoi mawaenakonu o ka pio i hoopaaia kona mau poo e ke kaula.*

MANAOHAI VII.

Ina ekolu mau kiko, aole nae ma ke kaha pololei lakou, ua hiki ke kaha i ke anapuni hookahi e pili ana ma ia mau kiko, a hookahi wale no.

O na kiko A, E, I oia na kiko i haawiia.

E kaha i na kaha AE, EI, a e mahele alikealike ia mau kaha e na kahakupono KU, HL; ke olelo mua nei kakou e halawai ana na kaha KU, HL ma kekahi kiko O.



No ka mea, e halawai no laua, ke ole laua i kaulike. Ina ua kaulike, alaila, o ke kaha AE i kupono ia KU, ua kupono hoi oia ia HL, a o ka huina M he huina kupono ia (Buke I. Manaohai XX. Manaopili 1.). Aka E M, o ka nee ana ae o ke kaha AE, he kaha okoa ia, a okoa ke kaha EH, no ka mea, aole ma ke kaha pololei hookahi na kiko ekolu A, E, I; nolaila ua loaa na kaha kupono elua EH, EM, i kahaia mai ke kiko hookahi E e kupono ana i ke kaha hookahi LM, o ka mea hiki ole no ia (Buke I. Manaohai XIV.); nolaila ua halawai no na kaha KU, HL ma kekahi kiko O.

Eia hoi, no ka moe ana o keia kiko O ma ke kaha kupono KU, ua like kona loa mai na kiko A a me E mai (Buke I. Manaohai XVI;) a no ka moe ana o ua kiko nei O ma ke kaha kupono HL, ua like kona loa mai na kiko E a me I mai: nolaila ua like na loa ekolu OA, OE, OI; nolaila, o ke anapu-

ni i kahaia mai ke kikowaena O ma ka hanai OE, e pili no ia ma na kiko ekolu A, E, I.

Ua akaka ae la, ua hiki no ke kahaia ke anapuni e pili ana i na kiko ekolu, ke ole lakou ma ke kaha pololei hookahi: ke olelo hou aku nei kakou, ua hiki ke kaha i ke anapuni hookahi wale no, e pili ana ma ua mau kiko la.

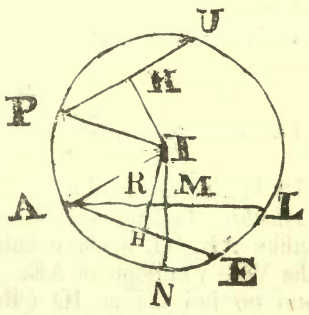
No ka mea, ina he anapuni hou ae e pili ana i na kiko A, E, I, aole hiki kona kikowaena mawaho ae o ke kaha KU, no ka mea, ua like ole ilaila kona loa mai na kiko A a me E mai (Buke I Manaohai XVI.); aole hoi i hiki kona kikowaena mawaho ae o ke kaha HL, no ka mea, ilaila ua like ole kona loa mai na kiko E a me I mai; nolaila, ua moe no kona kikowaena maloko o na kaha pololei elua KU a me HL. Aka halawai na kaha pololei elua ma ke kiko hookahi wale no; nolaila, ua hiki ke kaha i ke anapuni hookahi wale no e pili ana i na kiko ekolu i haawiia.

Manaopili. Ua hiki i na anapuni elua ke halawai ma na kiko elua wale no; no ka mea, ua hoakakaia mai nei, aole e hiki ia laua ke pili pu ma na kiko ekolu.

MANAOHAI VIII.

Ua like ka loa o na kaula like, mai ke kikowaena mai: a o na kaula like ole elua, ua nui ae ka loa mai ke kikowaena mai a i ke kaula pokole.

Akahi. I like ke kaula AE me ke kaula PU. E mahelelike ia mau kaula e na kaha kupono IH, IK, a e kaha i na hanai IA, IP. Iloko o na huinakolu kupono IAH, IPK, ua like na aoao loa IP, IA, a o ka aoao AH, ka hapalua o AE ua like ia me ka aoao PK ka hapalua o PU: nolaila, ua like ia mau huinakolu, a ua like ka aoao IH me ka aoao IK (Buke I Manaohai XVII.); nolaila, ua like ka loa mai ke kikowaena mai a hiki i na kaula like elua AE, PU.

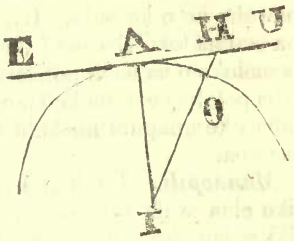


Alua. I nui aku ke kaula AL i ke kaula PU. Ua nui aku ka pio ANL i ka pio POU (Manaohai V.); No ka pio mua ANL e oki aku i ke kau wahi ANE = POU; a e kaha i ke kaula AE, a e kaha mai i ke kaha IH i kupono ia AE, a me IM i

kupono ia AL. Ua maopopo, ua nui aku IH ia IR, a ua nui aku IR ia IM (Buke I Manaohai XV.); nolaila loa, ua nui aku IH ia IM. Aka ua like IK me IH; nolaila IK 7 IM; nolaila, o na kaula like ole, ua nui ae ka loa mai ke kikowaena mai a i ke kaula pokole.

MANAOHAI IX.

O ke kaha pololei i kupono i kekahi hanai ma kona welau, he kahapili ia i ke anapuni.



I kupono ke kaha EU i ka hanai IA ma kona welau A; alaila he kahapili EU i ke anapuni. No ka mea, ua nui aku na kaha hio a pau, me IH, i ke kaha kupono IA (Buke I. Manaohai XV.); nolaila, o ke kiko H, mawaho aku ia o ka poai; nolaila ua pili ke kaha EU me ke anapuni ma ke kiko A wale no: a nolaila, he kahapili o EU (Hoakaka 8.).

He Wehewehe. Ma kekahi kiko A i haawiia, ua hiki ke kahaia ke kahapili AE hookahi wale no e pili ana i ke anapuni; no ka mea, ina he mea hiki ke kaha ae i kekahi kahapili e ae, aole ia i kupono i ka hanai IA (Buke I. Manaohai XIV. Wehewehe); nolaila, ua moe hio ka hanai AI i keia kahapili hou, a o ke kahakupono mai ke kikowaena mai a i keia kahapili, ua pokole mai ia ia IA: a nolaila ua komo mai keia kahapili hou, i manaoia, iloko o ka poai, a lilo iho la i kahaoki.

MANAOHAI X.

Ua okiia na pio like o ke anapuni, mawaena o na kaulike elua.

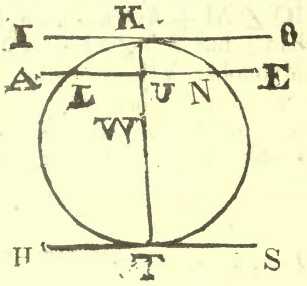
Ua hiki na ano ekolu.

Akahi. Ina he mau kahaoki na kaulike AE, IO, alaila e kaha i ke kaha WK i kupono ia AE. E kupono no hoi oia ia IO (Buke I. Manaohai XX. Manaopili 1.); nolaila, ua ku ke kiko K mawaenakonu o ka pio LKN, a o ka pio MKP (Manaohai VI.); nolaila, ua loaa ia

kakou, ka pio LK = NK, a me ka pio MK = KP; a nolaila LK — MK = KN — KP; oia no LM = NP.

Alua. Ina o na kaulike AE, IO, he kahaoki kekahi, a he kahapili kekahi, alaila e kaha i ka hanai WK i ke kiko pili K, e kupono no ia i ke kahapili IO (Manaohai 1X.), a i kona kaulike hoi AE. Aka no ke kupono ana o WK i ke kaula AE, nolaila, ua ku ke kiko K mawaena konu o ka pio LKN (Manaohai VI.); nolaila, ua like na pio LK, NK, i hopuia iwaena o na kaulike AE, IO.

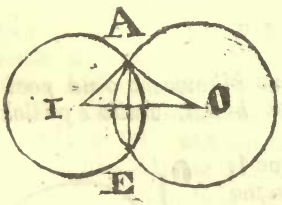
Akolu. Ina he mau kahapili na kaulike IO, HS, e pili ana kekahi ma ke kiko K, a o kekahi ma ke kiko T; e kaha i ke kahaoki AE i kaulike hoi: ma ka mea i hoikeia'e nei, ua loaa ia kakou LK = NK, a me LT = NT; a nolaila ua like ka pio okoa KLT = KNT.

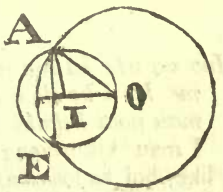


MANAOHAI XI.

Ina i oki kekahi mau poai elua kekahi i kekahi ma na kiko elua, alaila ua kupono ke kaha i hui ai ko laua mau kikowaena i ke kaula i hui ai na kiko o ka okiana, a e mahele alikealike oia i ua kaula la.

No ka mea, e kaha i ke kaha AE e hui pu ana i na kiko o ka okiana. He kaula keia o ia mau poai a elua, e kuku-

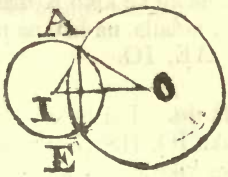




lu iho i ke kaha kupono mawaenakonu o keia kaula, e holo no ia ma na kikowaena elua I a me O (Manaohai V I. Wehewehe). Aka, hookahi wale kaha pololei i hiki ai ke kahaia iwaena o na kiko elua; nolaila, o ke kaha pololei i holo ai ma na kikowaena, oia ke kupono i ke kaula, a oki alikealike ia ia.

MANAOHAI XII.

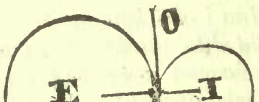
Ina ua uuku iho ka loa mawaena o na kikowaena o na poai elua i ka houluuluana o ko laua mau hanai, e uuku ana nae ka hanai nui i ka houluuluana o ka hanai iki me ka loa mawaena o na kikowaena; alaila e oki ko laua mau anapuni kekahi i kekahi.



No ka mea, he mea pono ke loaa mai ka huinakolu AIO, i hiki ai ia mau poai ke oki kekahi i kekahi. No ia mea, ua pono ke loaa mai keia, IO ∠ AI + AO, a o keia hoi, o ka hanai nui AO ∠AI + IO (Buke I. Manaohai VII.). A ina he mea hiki ka huinakolu AIO ke hanaia, alaila, ua maopopo keia, o na poai nona na kikowaena I a me O e oki laua kekahi i kekahi ma na kiko A a me E.

MANAOHAI XIII.

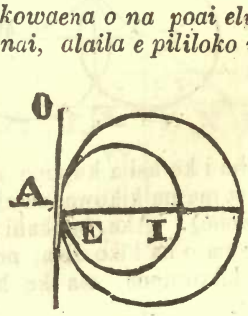
Ina ua like ka loa mawaena o na kikowaena o na poai elua me ka houluulu ana o na hanai o ia mau poai, alaila e piliwaho laua kekahi me kekahi.



I mau kikowaena ma E a me I; i like hoi ka loa mawaena o laua me EA + AI. Ua loaa maopopo le kiko A i ua mau poai a elua, aole hoi i loaa kekahi kiko e ae; no ka mea, ina ua loaa kekahi kiko e ae, alaila ua uuku iho ka loa mawaena o ko laua mau kikowaena i ka houluuluana o ko laua mau hanai.

MANAOHAI XIV.

Ina ua like ka loa mawaena o na kikowaena o na poai elua me ka like ole o ko laua mau hanai, alaila e pililoko ia mau poai kekahi me kekahi.



I mau kikowaena ma E a me I, i like hoi ka loa mawaena o laua me AI — AE. Ua loaa maopopo, e like me mamua, ke kiko A i ua mau poai la a elua: aole hoi e loaa kekahi kiko hookahi e ae ia laua a elua; no ka mea, ina ua loaa, alaila ua uuku iho ka hanai nui AI i ka houluuluana

o ka hanai AE a me ka loa EI mawaena o na kikowaena (Manaohai XII.); he mea kue ia i ka olelo mua.

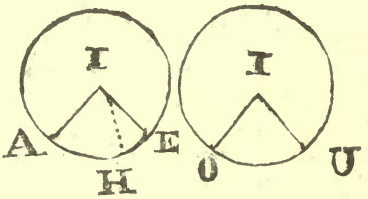
Manaopili. Ina ua pili maloko a mawaho paha na poai elua, ua moe ko laua mau kikowaena a me ke kiko o ka pili ana ma ke kaha pololei hookahi.

He Wehewehe. O na poai a pau e moe ana ko lakou mau kikowaena ma ke kaha pololei AI, a ua holo ke anapuni ma ke kiko A; he mau kahapili ia mau poai kekahi i kekahi. No ka mea, ia lakou a pau ke kiko A, a ina ma ke kiko A i kahaia ke kaha AO e kupono ana ia AI, alaila he kahapili ke kaha AO i kela mau poai a pau.

MANAOHAI XV.

Iloko o ka poai hookahi, a iloko o na poai like, ua hopu na huinalike, e ku ana ko lakou mau kihi ma ke kikowaena, i na pio like; a o keia hoi, ina ua like na pio i hopuia'i e na hanai, alaila, ua like hoi na huina iwaena o ia mau hanai.

I mau kikowaena ma I a me I o na poai like, i like hoi ka huina AIE = OIU.



Akahi. No ka like ana o na huina AIE, OIU ua hiki ke kauia kekahi maluna o kekahi; a no ka like ana o ko laua mau aoao, e kau no ke kiko A maluna o ke kiko O, a o ke kiko E maluna o ke kiko U.

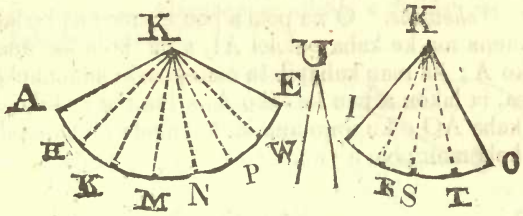
Alaila ua pili pono ka pio AE maluna o ka pio OU; no ka mea, ina aole laua i pili loa, ina ua loaa iloko o kekahi o laua na kiko i like ole ka loa mai ke kikowaena mai; he mea hiki ole ia: nolaila, ua like ka pio AE me OU.

Alua. Ina ua like ka pio AE me ka pio OU, alaila ua like ka huina AIE me OIU. No ka mea, ina aole i like laua, e manaoia AIE oia ka nui o laua, a e lawe ia AIH i huina like me OIU. Ma ka mea i hoakakaia'e maluna nei, ua loaa ia kakou AH = OU: aka ma ka olelo mua ua like AE me OU; nolaila, ua like AH me AE, o ka apana me ka mea okoa, he mea hiki ole (AK. 8.): nolaila, ua like ka huina AIE me OIU.

MANAOHAI XVI.

Iloko o ka poai hookahi, a iloko hoi o na poai like, ina ua like ka ratio o na huina elua ma ke kikowaena me ka ratio o kekahi mau helu okoa; alaila ua like ka ratio o na

poai i hopuia, kekahi i kekahi me ka ratio o ia mau helu okoa, a ua loaa ia kakou ka huina i ka huina, me ka like ana o ka poai kue i ka poai kue.

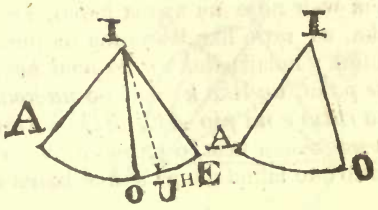


Ma ka manao ana, i like ka ratio o ka huina AKE ia IKO me ke ratio o 7 ia 4; ua like ia me neia, ke kahaia ka huina U i ana no ia mau huina, he hapahiku oia o ka huina AKE, a he hapaha oia o ka huina IKO. A o na hakina huina ehiku AKH, HKK, KKM, &c. i puunauweia'i ka huina AKE, ua like kela hakina huina keia hakina huina o lakou me kekahi o na hakina huina eha IKR, RKS, &c i puunauweia'i ka huina IKO; nolaila, ua like kela hakina pio keia hakina pio AH, HK, KM, &c. me kela hakina pio keia hakina pio IR, RS, ST, TO (Manaohai XV.). Nolaila, ua like ka ratio o ka pio okoa AE i ka pio okoa IO me ka ratio o 7 ia 4. Pela no hoi, ua hiki ke hoomoakakaia mai, ina i waihoia ka 7 a me ka 4, a hookomoia kekahi mau hua helu e ae: nolaila, me ka like ana o ka huina AKE i ka huina IKO, pela no ka pio AE i ka pio IO.

He Wehewehe. Ina ua like ka ratio o na pio AE, IO me ka ratio o kekahi mau hua helu okoa; alaila, ua like hoi ka ratio o na huina AKE, IKO me ka ratio o ia mau helu okoa la, a ua loaa mai ia kakou AKE: IKO:: AE: IO: no ka mea ua like na hakina pio AH, HK, KM&c. a me IR, RS, &c. nolaila ua like hoi na hakina huina AKH, HKK, &c. a me IKR, RKS &c.

MANAOHAI XVII.

O ka ratio o na huina elua, kekahi i kekahi, ua like mau ia, me ka ratio o na pio iwaena o ko laua mau aoao kekahi i kekahi; ke kahaia ia mau pio mai na kihi aku o ia mau huina, ma na hanai like.



I mau huina elua; AIE ka huina nui, AIO ka huina uuku. E kau i ka huina uuku maluna ae o ka huina nui. Ina he oiaio ole ka manaohai, alaila, me ka like ana o ka huina AIE i ka ka huina AIO, pela no ka like ana o ka pio AE i kekahi pio nui aku, a uuku iho paha ia AO.

I nui aku paha me AH; alaila ua loaa keia ia kakou, o ka huina AIE : AIO : : ka pio AE : ka pio AH. Alaila e manao wale, ua puunauweia ka pio AH i mau hakina like, a ua uuku iho kela hakina keia hakina ia OH; e haule no kekahi kiko o ka puunaue ana mawaena o O a me H; ma U paha ia kiko; e kaha ia IU. Ua like ka ratio o na pio AE, AU me ka ratio o kekahi mau hua helu elua e ae; a ma ka manaohai maluna ae nei ua loaa ia kakou ka huina AIE : ka huina AIU : : ka pio AE : ka pio AU. I ka nana aku ana i keia mau like ana, ua ike kakou, ua like wale no na hikimua o kela a o keia, nolaila ua ratio like na ukali (Buke II, Manaohai IV.): Malaila ua loaa ia kakou, ka huina AIO : ka huina AIU : : ka pio AH : ka pio AU. Aka ua nui ae ka pio AH i ka pio AU, nolaila, ina he oiaio ka like ana, ua nui ae ka huina AIO i ka huina AIU, aka, ua uuku iho no nae; nolaila, aole e hiki ka huina AIE : ka huina AIO : : ka pio AE : ka pio nui ae ia AO.

Pela no hoi, ua hiki ke hoakakaia, aole hiki ka ha o na kuaniti o keia like ana ke uuku iho ia AO; nolaila o AO iho no ia; nolaila ua loaa ia kakou ka huina AIE : huina AIO : : pio AE : pio AO.

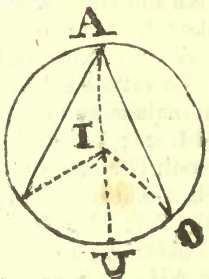
Manaopili. Ua ikea ka pili pu ana o ke ano o ka huina ma ke kikowaena o ka poai, me ke ano o ka pio mawaena o kona mau aoao: ma ka ratio i mahuahua ai a i emi ai paha kekahi, ma ia ratio no ua mahuahua a ua emi iho kekahi, nolaila, ua pono ia kakou ke lawe i kekahi o ia mau kuaniti i ana no kekahi: a ma neia hope aku, e lawe ana kakou i ka pio AE i ana no ka huina AIE.

He Wehewehe. O na mea a pau i hoakakaia ma keia mau manaohai hope nei ekolu, no ka hoohalike pu ana o na huina a me na pio, ua pili no ia mau mea a pau ke hoohalikeia na apana hanai a me na pio. No ka mea, aole o ka like

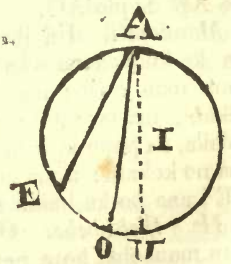
ana wale no o na apana hanai, ke like ko lakou mau huina, aka. ua ratio like lakou ma na mea a pau me ko lakau mau huina: nolaila *iloko o ka poai hookahi, a iloko o na poai like paha, ua like ka ratio o na apana hanai AIE, AIO me ka ratio o na pio AE, AO, ko laua mau kaha moe.* Nolaila ua akaka keia, o na pio o ka poai, na ana o na huina, ua ratio like lakou me na apana hanai o ia poai, a o na poai like.

MANAOHAI XVIII.

Ua anaia ka huinakahalokoia e ka hapalua o ka pio mawaena o kona mau aoao.

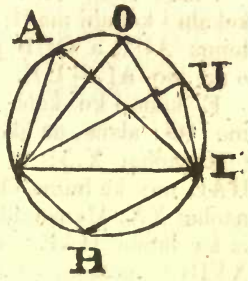


I huina kahalokoia EAO, a e manao mua kakou ua moe ke kikowaena o ka poai mawaena o ka huina EAO. E kaha i ke anawaena AU, a me na hanai IE, IO. O ka huina EIU mawaho ia i ka huinakolu AEI, a ua like ia me ka houluulu ana o na huina iloko elua IAE, + AEI, (Buke I. Manaohai XXV. Manaopili 6.); aka o ka huinakolu AIE he huinakolu elua aoaolike ia, a ua like ka huina IAE me ka huina AEI; nolaila ua palua ka huina EIU i ka huina EAI. No ka moe ana o ka huina EIU ma ke kikowaena, ua anaia oia e ka pio EU; nolaila ua anaia ka huina EAI e ka hapalua o ka pio EU. Pela no hoi, ua anaia ka huina IAO e ka hapalua o ka pio UO; nolaila, ua anaia EAI + IAO oia no EAO e ka hapalua o EU + UO oia no EO.

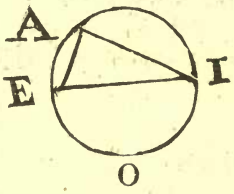


E manao hou kakou, ua moe ke kikowaena I mawaho aku o ka huina EAO. E kaha i ke anawaena AU, ua anaia ka huina EAU e ka hapalua o EU; ua anaia hoi ka huina OAU e ka hapalua o OU; nolaila ua anaia ka huina EAU — OAU = EAO e ka hapalua o ka pio EU — OU = EO.

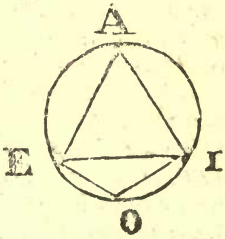
Nolaila ua anaia kela huinakahalokoia, keia huinakahalokoia e ka hapalua o ka pio mawaena o kona mau aoao.



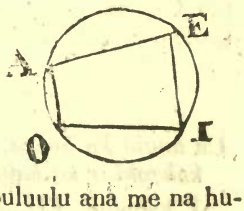
Manaopili 1. Ua like na huinakahalokoia a pau EAI, EOI, EUI, iloko o ka apana hookahi; no ka mea, ua anaia lakou a pau e ka hapalua o ka pio hookahi EHI.



Manaopili 2. He huina ,kupono na huina a pau EAI i kahalokoia iloko o ka hapalua poai; no ka mea, ua anaia oia e ka hapalua o ka hapalua anapuni EOI, oia no ka hapaha o ke anapuni okoa.



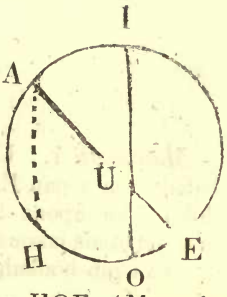
Manaopili 3. He huina oi na huina a pau me EAI i kahalokoia iloko o ka apana nui aku i ka hapalua poai; no ka mea, ua anaia oia e ka hapalua o ka pio EOI, ka i uuku i ka hapalua anapuni.



Manaopili 4. Iloko o ka huinaha AEIO i kahalokoia, ua like ka houluulu ana o na huina kue A a me I me na huina kupono elua: no ka mea, ua anaia ka huina OAE e ka hapalua o ka pio OIE; a ua anaia ka huina EIO e ka hapalua o ka pio EAO; nolaila hoi, ua anaia keia mau huina elua OAE a me OIE e ka hapalua poai; nolaila, ua like ko laua houluulu ana me na huina kupono elua.

MANAOHAI XIX.

Ua anaia ka huina, i hanaia e na kaula elua, ka i oki kekahi i kekahi, e ka hapalua o na pio iwaena o kona mau aoao.



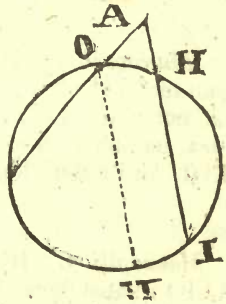
I mau kaula elua AE, IO, e oki ana kekahi i kekahi ma U; alaila, ua anaia ka huina AUI, a OUE paha e ka hapalua o na pio AI + OE.

E kaha i ke kaha AH e kaulike ana me IO: alaila, ua like ka pio AI me HO (Manaohai X.); a ua like ka huina HAE me ka huina OUE (Buke I. Manaohai XX. Manaopili 3.). Aka, ua anaia ka huina HAE e ka hapalua o ka pio HOE (Manaohai XVIII.); nolaila, ua anaia ka huina OUE e ka hapalua o ka pio HOE; oia no ka hapalua o HO + OE, oia no ka hapalua o AI + OE

Pela no, ua hiki ke hookakaia, ua anaia ka huina AUO e ka hapalua o AHO + EI.

MANAOHAI XX.

Ua anaia ka huina, i hanaia e na kahaoki elua, e ka hapalua o ka likeole o na pio iwaena o kona mau aoao.

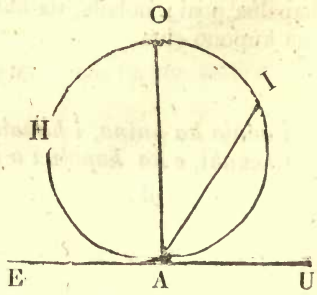


I mau kahaoki elua AE, AI; alaila, ua anaia ka huina EAI e ka hapalua o ka likeole o na pio EUI a me OH.

E kaha i ke kaha OU e kaulike ana me AI: alaila, ua like ka pio OH me UI, a ua like ka huina EOU me ka huina EAI. Aka, ua anaia ka huina EOU e ka hapalua o ka pio EU; nolaila, ua anaia ka huina EAI e ka hapalua o ka pio UE; oia no ka hapalua o ka likeole o na pio EUI, OH.

MANAOHAI XXI.

Ua anaia ka huina, i hanaia e kekahi kahapili a me kekahi kahaoki, e ka hapalua o ka pio iwaena o kona mau aoao.



I kahapili EU, a i kahaoki AI. Ua anaia ka huina EAI e ka hapalua o ka pio AHOI.

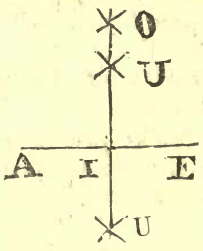
Mai ke kikopili A e kaha aku i ke anawaena AO. He huina kupono ka huina EAO (Manaohai XI.). a ua anaia oia e ka hapalua o ka hapalua anapuni AHO; ua anaia ka huina

OAI e ka hapalua o ka pio OI: nolaila, ua anaia na huina EAO + OAI, oia no EAI, e ka hapalua o na pio AHO + IO oia no AHOI. Ua akaka no hoi, ma ka lawe ana i ka like ole o na huina OAU a me OAI, ua anaia IAU e ka hapalua o ka pio AI iwaena o kona mau aoao.

HE MAU NANEHAI E PILI ANA I KA BUKE AKAHI A ME KA BUKE AKOLU.

NANEHAI I.

E mahele mawaenakonu i kekahi kaha i hoikeia.

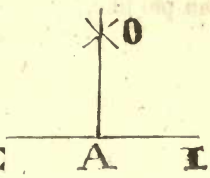


AE ke kaha hoikeia. Mai na kiko A a me E, me he mau kikowaena la, me ka hanai i nui aku i ka hapalua o AE, e kaha i kekahi mau pio elua e oki ana kekahi i kekahi ma ke kiko O; ua like ka loa mai ke kiko O aku a ia A a me E. Pela hoi e imi hou ai maluna ae paha o ke kaha AE, malalo iho paha, i kekahi kiko U e ae, i like kona loa mai na kiko A a me E aku: Ma na kiko O a me U e kaha i ke kaha OU: e mahelelike oia i ke kaha AE ma 1.

No ka loalike ana o na kiko O a me U mai na welau A a me E mai, nolaila, ua moe laua a elua iloko o ke kaha kupono i kukuluia ma ke kikowaenakonu o ke kaha AE (Buke I Manaohai XVI. Manaopili.). Aka ua hiki ke kaha i ke kaha pololei hookahi wale no ma na kiko elua: nolaila, ua kupono OU ia AE, a ua mahele oia ia ia mawaenakonu, ma ke kiko I.

NANEHAI II.

Ma kekahi kiko i hoikeia, iloko o kekahi kaha pololei i hoikeia, e kukulu i kaha kupono i ua kaha nei.



Ua hoikeia ke kiko A, a o EI ke kaha. E lawe i mau kiko E a me I, i like ko laua loa mai ke kiko A mai; alaila mai keia mau kiko, me he mau kikowaena la, me ka hanai i nui aku ia EA e kaha i kekahi mau pio e oki ana kekahi i kekahi ma O; e kaha ia OA; oia ke kaha kupono i imihia. No ka mea, ua like ka loa mai ke kiko O aku a ia E a me I, nolaila, ua moe oia iloko o ke ka-

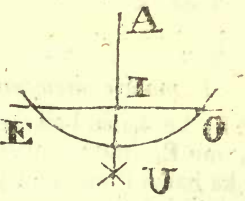
ha kupono i kukuluia mawaenakonu o EI (Buke I. Manaohai XVI.): ua maopopo ke kaha, ke loaa na kiko elua, nolaila, o AO no ua kaha kupono nei.

He Wehewehe. Peia no ka hana ana i ka huina kupono EAO, ma ke kiko A i hoikeia, iloko o ke kaha EA i hoikeia.

NANEHAI III.

Mai kekahi kiko i hoikeia, kaawale i kekahi kaha pololei i hoikeia, e hookuu ilalo i kaha kupono i ua kaha nei.

I kiko A, EO ke kaha pololei.



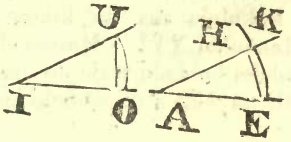
Mai ke kiko A, me he kikowaena la, me ka hanai e hiki ai, e kaha i ka pio e oki ana i ke kaha EO i na kiko elua ma E a me O; alaila, e hoomaopopo i kekahi kiko U i like kona loa mai na kiko E a me O mai, a e kaha i ke kaha AU: o ke kaha kupono iho la no ia i imihia.

No ka mea, ua like ka loa mai na kiko A a me U aku a ia E a me O; nolaila, he kaha kupono AU e oki ana mawaenakonu o EO (Buke I Manaohai XVI. Manaopili).

NANEHAI IV.

Ma kekaki kiko iloko o kekahi kaha i hoikeia, e hana i huina like me kekahi huina e ae i hoikeia.

A ke kiko i hoikeia iloko o ke kaha AE, a OIU ka huina, i hoikeia.

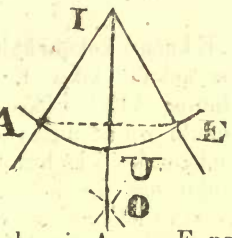


Mai ke kihi I, me he kikowaena la, me kekahi hanai e kaha i ka pio OU e pili ana i na aoao elua o ka huina. Mai ke kiko A me he kikowaena la, me ka hanai AE, like me IO, e kaha i ka pio EH: alaila me ka hanai like me ke kaula UO, ma ke kiko E me he kikowaena la, e kaha i ka pio e oki ana i ka pio EH ma ke kiko K; e kaha i ke kaha AK, ua like ka huina KAE me ka huina OIU i hoikeia.

No ka mea, ua like na hanai o na pio elua OU a me EK a ua like hoi ko laua mau kaula; nolaila ua like laua (Manaohai IV.); nolaila, ua like na huina EAK, OIU i anaia e ia mau pio like.

NANEHAI V.

E mahele mawaenakonu i kekahi pio a i kekahi huina paha.



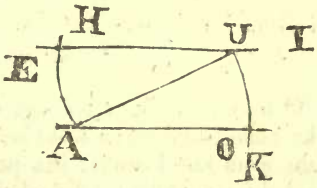
Akahi. E mahele i ka pio AUE i elua hakina like. Mai na kiko A a me E me he mau kikowaena la, me kekahi hanai hookahi, e kaha i kekahi mau pio elua e oki ana kekahi i kekahi ma O; ma ke kiko O a me ke kikowaena I e kaha i ke kaha IO: e mahele no oia i ka pio AE mawaenakonu, ma ke kiko U. No ka mea, ua like ka loa mai na kiko I a me O aku a ia A a me E, na welau o ke kaula AE: nolaila, ua mahele like ke kaha IO i ua kaula la, a ua kupono hoi ia ia (Buke I: Manaohai XVI. Manaopili); nolaila, ua mahele like oia i ka pio AUE ma ke kiko U (Manaohai VI.).

Alua. E mahele i ka huina AIE, i elua huina like. Mai ke kihi I me he kikowaena la, e kaha i ka pio AUE: a e mahele i ua pio nei e like me ka hana ana maluna. A ua maopopo, ua maheleia ka huina AIE e ke kaha IO i elua huina like.

He Wehewehe. Ma ka hana ana e like me neia, ua hiki ke mahele hou i na hapalua AU, UE: a pela ma ka mahele hou ana, e hiki ai ke hoomaheleia ka huina, ka pio paha, i eha paha like, i ewalu, i umikumamaono, a pela aku no.

NANEHAI VI.

Ma kekahi kiko i hoikeia, e kaha i ke kaha kaulike me kekahi kaha pololei e ae i hoikeia.

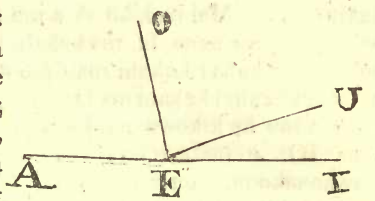


A ke kiko, EI ke kaha i haawiia. Mai ke kiko A me he kikowaena la, me kekahi hanai nui aku i ka loa pokole mai A aku a i ke kaha EI, e kaha i ka pio UK: me ia hanai no, mai ke kiko U me he kikowaena la, e kaha i ka pio AH; e hoolilo ia UO = AH, a e kaha i ke kaha AO; oia no ke kaulike i imihia.

No ka mea, ma ke kaha ana i ke kaha AU, ua maopopo ka like ana o na huina io ia nei AUH, UAO; nolaila ua kaulike na kaha AO, EI, (Buke I. Manaohai XIX. Manaopili I.).

NANEHAI VII.

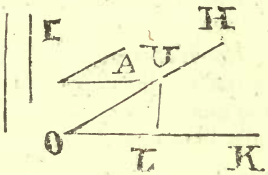
Ua hoikeia na huina elua o kekahi huinakolu, i loaa mai ke kolu.



E kaha i kekahi kaha AEI: ma kekahi kiko E, e hana i huina AEO, i like oia me kekahi o na huina i hoikeia; a e hana hoi i ka huina OEU, i like oia me kekahi o na huina i hoikeia; alaila, ua like ka huina i koe UEI me ke kolu o na huina i imiia; no ka mea, ua like kela mau huina ekolu me na huina kupono elua (Buke I. Manaohai I a me XXV.).

NANEHAI VIII.

E kaha i ka huinakolu, ua hoikeia mai na aoao elua ona a me ka huina iwaena o laua.

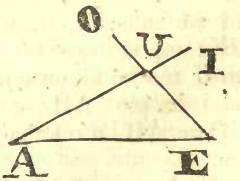


I mau kaha E a me I like me na aoao i hoikeia, a o A ka huina i hoikeia.

E kaha wale i kekahi kaha OK, a ma ke kiko O e hana i ka huina KOH like me ka huina A; alaila, e lawe ia OL = I a me OU = E, a e kaha i ke kaha UL; o ka huinakolu OUL ka huinakolu i makemakeia (Buke I. Manaohai V·).

NANEHAI IX.

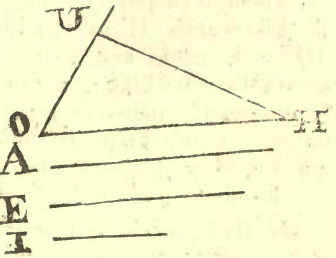
E kaha i ka huinakolu, ua hoikeia ka aoao hookahi ona, a me na huina elua.



O na huina elua i hoikeia, ua pili laua i ka aoao i hoikeia; a i ole ia, ua pili kekahi a ua kue kekahi, ina pela, e imi i ke kolu o na huina (Nanehai VII.); a pela ua loaa na huina pili elua: e kaha i ke kaha AE i like oia me ka aoao i hoikeia: ma ke kiko A e hana i huina EAI i like oia me kekahi o na huina pili i hoikeia, a ma ke kiko E e hana i huina AEO i like oia me kekahi o na huina pili i hoikeia: e oki ana na kaha AI, EO kekahi i kekahi ma U; a o AEU ka huinakolu i makemakeia (Buke I. Manaohai VI.).

NANEHAI X.

E kaha i ka huinakolu i hoikeia kona mau aoao ekolu.

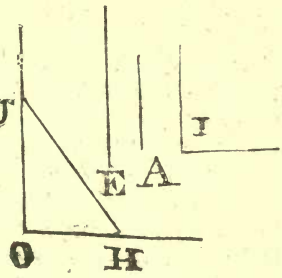


A, E, I, na aoao i hoikeia. E kaha ia OH e like me A: mai ke kiko H me he kikowaena la, me ka hanai like me E, e kaha i ka pio; mai ke kiko O me he kikowaena la, me ka hanai like me I, ke kolu o na aoao, e kaha hoi i pio e oki ana i kela pio ma U; e kaha ia UO a me UH; a o OUH ka huinakolu i makemakeia (Buke I Manaohai X·).

He Wehewehe. Ina i nui aku kekahi aoao i ka houluulu-ana o na aoao e ae elua, aole e oki na pio kekahi i kekahi: aka, ua mohala mau, ke nui aku na aoao elua, i lawe kikokikoi-ia, i ke kolu.

NANEHAI XI.

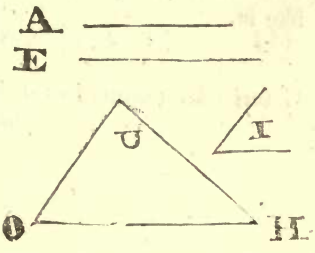
E kaha i ka huinakolu, ua hoikeia na aoao elua ona a me ka huina kue i kekahi o laua.



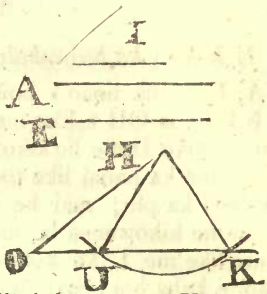
A a me E na aoao i hoikeia, a o I ka huina i hoikeia Elua hana ana.

Akahi. Ina he huina kupono ka huina I, a he huina peleleu paha, e hana i ka huina UOH = I: e lawe ia OH = A; mai ke kiko H me he kikowaena la, me ke hanai like me ka aoao E e kaha i ka pio e oki ana i ke kaha OU ma U, a kaha ia HU: alaila, OUH ka huinakolu i makemakeia.

Iloko o keia hana mua ana, he pono ke oi aku ka aoao E ia A; no ka mea, he huina kupono ka huina I, a he peleleu paha, a nolaila, ua nui aku i kekahi huina e ae o ka huinako-lu, a nolaila, o ka aoao kue ia ia, oia ka aoao loa (Buke I. Ma-naohai XIII.).



Alua. Ina he huina oi ka huina I, a ua nui aku ka aoao E ia A, alaila ua like ka hana ana me keia hana mua ana, a OUH ka huinakolu i imihia.



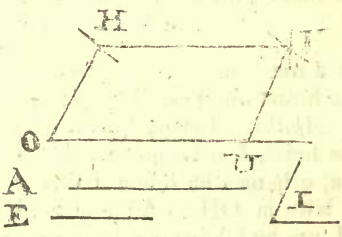
Aka, ina he huina oi ka huina I, a ua uuku ka aoao E ia A, alaila, o ka pio e kahaia, mai ke kikowaena H me ka hanai HU = E, e oki ana ia pio i ka aoao OU ma na kiko elua, U a me K ma kekahi aoao o O: a nolaila, ua loaa na huinakolu elua OUH a me OKH e kupono like ana me ka olelo o ka nanehai.

He Wehewehe. Ina he kahapili i ka aoao OU ka pio i kahaia mai ke kikowaena H, alaila he huinakolu kupono ka huinakolu, a hookahi wale no hailoaa.

Ina he uuku iho ka aoao E i ke kaha kupono mai ke kiko H a ia OU, alaila, aole hiki ka huinakolu ke hanaia.

NANEHAI XII.

E kaha i ka huinahakaulike, ua hoikeia na aoao pili a me ka huina mawaena o ia mau aoao.



A a me E na aoao i hoikeia; I, ka huina.

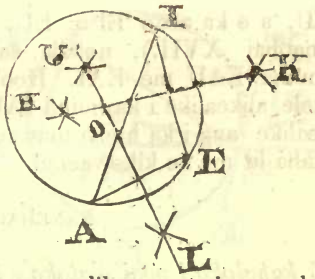
E kaha ia OU = A: ma ke kiko O e hana i ka huina HOU = I; e lawe ia OH = E; a e kaha i mau pio elua, i kekahi mai ke kiko H me he kikowaena la, me ka hanai HK = OU, a i kekahi mai ke kiko U me he kikowaena la, me ka hanai UK = OH: a i ke kiko K, kahi i oki ai keia mau pio kekahi i kekahi e kaha ia HK a me UK; a ua like OHKU ka huinahakaulike i makemakeia.

No ka mea, ma ka hana ana, ua like na aoao kue, nolaila, he huinahakaulike ia (Buke I. Manaohai XXIX.): a ua hanaia oia me na aoao i hoikeia, a me ka huina i hoikeia.

Manaopili. Ina he huinakupono ka huina i hoikeia, alaila, he huinahaloa ia; ina ua like hoi na aoao, alaila, he huinahalike ia.

NANEHAI XIII.

E imi i ke kikowaena o kekahi poai, o kekahi pio paha, i hoikeia.

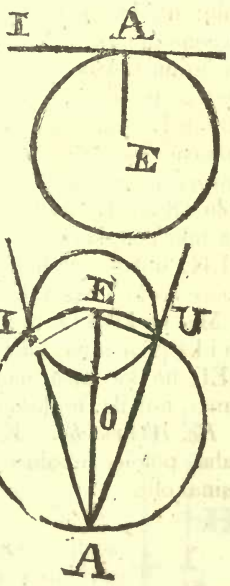


E lawe i kekahi mau kiko ekolu A, E, I ma ke anapuni, a ma ka pio paha: e kaha ia AE, EI,; e oki waenakonu ia mau kaha e na kaha kupono KH, LU: o ke kiko O kahi i halawai ai keia mau kaha kupono, ke kikowaena i imihia, (Manaohai VI. Wehewehe.)

He Wehewehe. Ma ka hana ana e like me keia, ua hiki ke kaha i ke anapuni ma na kiko hoikeia ekolu A, E, I; pela no hoi e kahaia ke anapuni, noloko ona ka hunakolu kahalokoia AEI.

NANEHAI XIV.

Ma ke kiko i hokeia e kaha i ke kahapili i kekahi poai i hoikeia.



Ina maloko o ke anapuni ke kiko A i hoikeia, e kaha i ka hanai EA, a e kukulu i ke kaha AI kupono ia ia: AI ke kahapili i imiia, (Manaohai IX.)

Ina mawaho aku o ka poai ke kiko A, e hui ia A a me ke kikowaena me ke kaha pololei AE: e mahele ia AE mawaenakonu ma O; mai ke kiko O me he kikowaena la, me ka hanai OE e kaha i ke anapuni e oki ana i ke anapuni i hoikeia ma I; e kaha ia AI, oia no ke kahapili i imihia. No ka mea, e kaha ia EI, he huina kupono ka huina AIE iloko o ka hapalua o ke anapuni: (Manaohai XVIII. Manaopili 2.) nolaila, ua kupono AI i ka welau o ka hanai EI; a nolaila he kahapili oia.

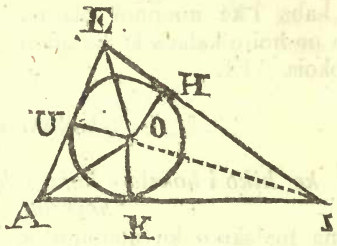
He Wehewehe. Aia e moe ana ke kiko A mawaho aku o ka poai, ua akaka, he mau loa na kahapili like elua AI a me AU e holo ana ma ke kiko A: ua like laua, no ka mea, hookahi aoao loa AE o na huinakolu kupono elua AEI,

AEU, a o ka aoao EI = EU, nolaila, ua like laua (Buke I. Manaohai XVII.), nolaila, ua like AU me AI, a ua like hoi ka huina EAU me EAI. Hookahi wale no kaha e hiki ai ke mahele alikealike i ka huina IAU, nolaila, o ke kaha e mahele alikealike ana i ka huina mawaena o na kahapili elua, ua holo ua kaha la ma ke kikowaena.

NANEHAI XV.

E kahaloko i poai maloko o kekahi huinakolu i hoikeia.

I huinakolu hoikeia AEI. E mahele likealike i na huina A a me E me na kaha pololei AO, EO, e halawai ana ma ke kiko O: mai ke kiko O, e hookuu i na kaha OU, OH, OK e kupono ana i na aoao ekolu o ka huinakolu: ua like keia mau kaha kupono a pau. No ka mea, ma ka hana ana, ua loaa ia kakou ka huina UAO = OAK, a o ka huinakupono AUO = AKO; nolaila, ua like ke kolu o na huina AOU me ke kolu AOK, (Buke I. Manaohai XXV. Manaopili 2.). Eia hoi, hookahi no aoao loa AO o na huinakolu elua AOU, AOK, a ua like hoi na huina kue i na aoao like; nolaila, ua like ia mau huinakolu (Buke I. Manaohai VI.); a nolaila, ua like UO me OK. Ua hiki pela ke hoakakaia ka like ana o na huinakolu OEU, OEH; nolaila, ua like OU me OH; nolaila, ua like na kaha kupono ekolu OK, OU, OH.

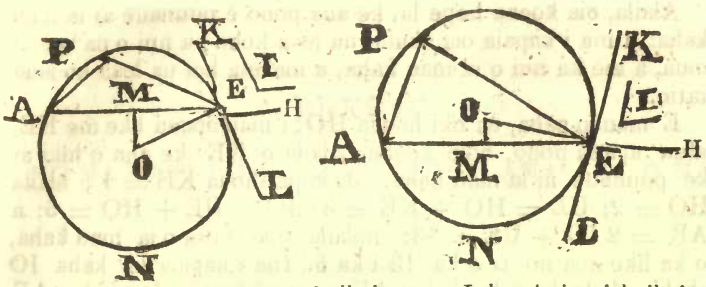


Mai ke kiko O, me he kikowaena la, me ka hanai OK, e kaha i ka poai, a ua kahalokoia ua poai la maloko o ka huinakolu AEI; no ka mea, ua kupono ka aoao AE i ka welau o ka hanai, nolaila, he kahapili ia; a pela no na aoao AI, EI.

He Wehewehe. E halawai ana no, ma ke kiko hookahi, na kaha pololei ekolu i mahele likealike i na huina o kekahi huinakolu.

NANEHAI XVI.

Maluna o ke kaha pololei i hoikeia, e kaha i ka apanapoai, e paa ana i kekahi huina i hoikeia: oia keia, i apana i like ai kela huina keia huina, i kahalokoia maloko ona, me kekahi huina i hoikeia.



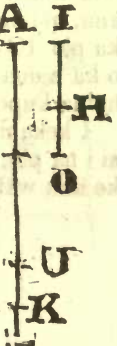
AE ke kaha pololei i hoikeia, a o I ka huina i hoikeia. Hooloihi ia AE a hiki ia H; ma ke kiko E e hana i ka huina HEK = I; e kaha ia EO e kupono ana ia KE, a e kaha hoi ia MO e kupono ana ia AE ma ke kikowaena M; mai ke kiko O, kahi i halawai ai keia mau kaha kupono, me he kikowaena la, me ka hanai OE e kaha i ka poai: APE ka apana i makemakeia.

No ka mea, no ke kupono ana o KL i ka hanai OE ma kona welau, nolaila, he kahapili oia, a ua anaia ka huina AEL e ka hapalua o ka pio ANE (Manaohai XXI.). A ua anaia no hoi ka huina kahalokoia APE e ka hapalua o ka pio ANE: nolaila, ua loaa ia kakou ka huina APE = AEL = KEH = I: nolaila, o kela huina keia huina i kahalokoia iloko o ka apana APE, ua like oia me ka huina I i hoikeia.

He Wehewehe. Ina he huina kupono ka huina i noikeia, alaila he hapaluapoai ka apana i imihia, e kahaia maluna o ke anawaena AE.

NENAHAI XVII.

E imi i ka ratio helu o kekahi mau kaha pololei i hoikeia, i manaoia hoi keia mau kaha, e loaa ia laua kekahi ana hookahi e hiki ai ke puunaue pono ia laua a elua.



AE a me IO na kaha pololei i hoikeia.

Mai ka nui o laua AE, e oki iho i kekahi mau apana like me IO, alua paha oki ana, a koe aku ke koena UE uuku iho ia IO.

Mai ke kaha IO e oki iho i mau apana e hiki ai ke oki e like me ia koena UE, hookahi paha oki ana, a keu aku HO.

Mai ke koena mua UE e oki iho i mau apana e hiki ai e like me HO, hookahi paha oki ana, a keu aku KE.

Mai ka lua o na koena HO e oki iho i mau apana e hiki ai e like me KE.

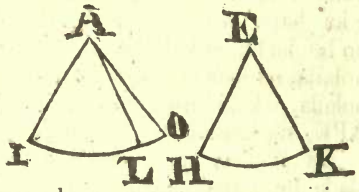
Pela no e hana ai a loaa ke koena e ana pono na i ke koena mamua iho.

Alaila, oia koena hope la, ke ana pono e puunaue ai ia mau kaha: a ina i kapaia oia akahi, ua loaa koke ka nui o na koena mua, a me ka nui o ia mau kaha, a malaila hoi ua loaa ko laua ratio.

E manao paha, ua oki hou ia HO, i mau apana like me KE, alua apana pono, aole koena; alaila o KE ke ana e hiki ai ke puunaue ai ia mau kaha. E kapa iho ia KE = 1; alaila HO = 2; UE = HO + KE = 3: IO = UE + HO = 5; a AE = 2 IO + UE = 13: nolaila, o ka ratio o ia mau kaha, o ka like ana no ia o ka 13 i ka 5. Ina i kapaia ke kaha IO akahi, alaila he $\frac{13}{5}$ ke kaha AE: a ina i kapaia ke kaha AE akahi, alaila he $\frac{5}{13}$ ke kaha IO.

NANEHAI XVIII.

Ua hoikeia kekahi mau huina elua, a ua imihia ke ana e puunaue pono ai ia laua; a, me ia pu hoi, ko laua ratio ma na helu.



A a me E na huina i hoikeia.

Me na hanai like e kaha i na pio IO, HK, i mau mea e ana ai i na huina. E hana aku e like me keia nanehai maluna ae, me ka oki iho i keia mau pio, a loaa ke ana e puunaue ai i na pio IO, HK, ina he mea hiki ia; a malaila ua loaa ka ratio o laua ma na helu: o keia ratio o na pio, oia no hoi ka ratio o na huina i hoikeia (Manaohai XVII.); a ina LO ke ana e puunaue pono ai ia mau pio, alaila LAO ke ana e puunaue pono ai i na huina.

He Wehewehe. Ma keia hana ana, ua hiki ke loaa ka waiwai maoli o ka huina, ma ka hoopili ana i ka pio, nana ia e ana, me ke anapuni okoa. Penei, ina paha ua like ka ratio o ka pio IO i ke anapuni okoa, me ka like ana o 3 ia 25, alaila, o ka huina A $\frac{3}{25}$ o na huina kupono eha: oia no hoi $\frac{12}{25}$ o ka huina kupono hookahi.

I kekahi manawa, aole i loaa mai ke ana e puunaue pono ai i na pio; ilaila, ua loaa ka ratio helu o na huina, ma ke koko-ke aku wale no.

BUKE IV

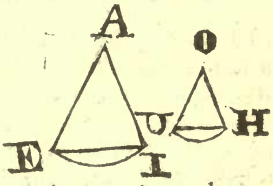
NO NA RATIO O NA KII, A ME KE ANA ANA O NA ILI.

He mau hoakaka.

1 O na kii ano like, oia no na kii i like na huina o kekahi me na huina o kekahi, kekahi me kekahi, a o na aoao e pili ana i na huina like, ua ratio like lakou.

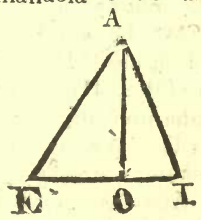
2 Ua kapaia na aoao elua, a o na huina elua e ku like ana maloko o na kii ano like, na aoao *homoloko*, na huina *homoloko*.

3 Iloko o na poai elua, *ua ano like na pio, a me na apana, a me na apanahanai*, i pili i na huina like ma ke kikowaena.



Penei, ina ua like na huina A a me O, alaila ua ano like na pio EI a me UH, a ua ano like ka apana nona ke kaula EI a me ka apana nona ke kaula UH; a ua ano like na apanahanai AEI, OUH.

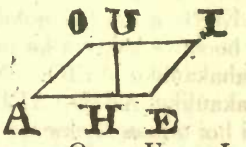
4 O ka *aoaomoe* o kekahi kii i hanaia e na kaha pololei, oia ka aoao i manaoia e ku ana ua kii la maluna ona.



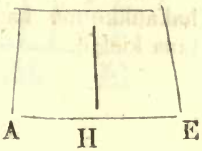
5 O ke *kiekie* o kekahi huinakolu, o ke kaha kupono ia, i hookuuia mai ke kihi o ka huina kue i ka aoao moe, a i ka aoao moe.

Penei, AO ke kiekie o ka huinakolu AEI.

6 O ke *kiekie* o kekahi huinahakaulike, oia no ke kaha kupono, i ana ai i ka loa mawaena o na aoao elua i laweia i mau kahamoe. Penei, UH ke kiekie o ka huinahakaulike OE.



7. O ke *kiekie* o kekahi huinahalualike, o ke kaha kupono ia mawaena o kona mau aoao i kaulike. Penei, HU ke kiekie o ka huinahalualike OE.



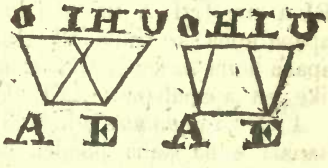
8 O *ka area* o kekahi kii, o kona *ili* no ia. Ke hoomaopopo mai nei *ka area* i ka nui o ka ili o ke kii. Ua hoikeia ka area e na helu penei; ua laweia kekahi area e ae i ana-akahi nona, me he ekere la, me he kapuai la, a ua heluia ke komo ana o keia area ana-akahi iloko o ka ili o ke kii, o kona area no ia.

9 Ua *like na area* o na kii, ke like ke komo ana o kekahi ana-akahi iloko o lakou.

10 Ua *waiwai like* na kii, ke like ko lakou mau area. Ua kapaia na kii he *like* lakou ke like lakou ma na ano a pau, a i hoopiliia kekahi me kekahi, ua ku like ma na wahi a pau (Akioma 13.); ke hoomaopopo mai nei ka hua *waiwai like* i ka like ana ma kekahi ano wale no; oia no ka like ana o na ana o na kii.

MANAOHAI I.

Aia i like na kahamoe a me na kiekie o na huinahakaulike, ua waiwailike lakou.



I kahamoe hookahi AE no na huinahakaulike AEIO, AE UH; a no ka like ana o ko laua kiekie, e moe ko laua mau kahamoe oluna OI a me HU ma ke kaha pololei hookahi e kaulike ana me ke kahamoe AE.

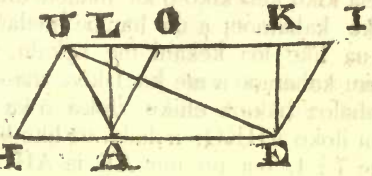
Ma ke ano o na huinahakaulike ua loaa ia kakou AO = EI, a me AH = EU; a me OI = AE, a HU = AE, nolaila, OI = HU; nolaila, ina i hoolaweia OI a me HU mai ke kaha hookahi OU, ua like na koena IU a me OH: nolaila, ua like na aoao o na huinakolu OAH, IEU, ko kekahi me ko kekahi, a nolaila, ua like laua (Buke I. Manaohai X.).

Aka, ina noloko mai o ka huinaha AEUO e hoolawe kakou i ka huinakolu AOH, alaila ua koe mai ka huinaha kaulike AEUH: a ina hoi noloko mai o ua huinaha hookahi AEUO e hoolawe kakou i ka huinakolu like IEU, ua koe mai ka huinahakaulike AEIO. Nolaila ua waiwai like keia mau huinahakaulike AEIO, AEUH, hookahi o laua kahamoe, a hookahi hoi o laua kiekie.

Manaopili. Ua waiwailike kela huinahakaulike keia huinahakaulike me ka huinahaloa, i like ko laua kahamoe, a me ko laua kiekie.

MANAOHAI II.

O kela huinakolu keia huinakolu, he hapalua ia o ka huinahakaulike, ke like ko laua kahamoe a me ko laua kiekie.



I huinahakaulike AEIO, i huinakolu AEU, hookahi kahamoe AE no laua, a hookahi hoi ko laua kiekie: he hapalua ka huinakolu o ka huinahakaulike.

No ka mea, no ka like ana o ke kiekie o ka huinakolu me ko ka huinahakaulike, e moe ana ke kihi U o ka huinakolu, iloko o ke kaha UI e kaulike ana me AE ke kaha moe. E hooloihi ia EA, mai ke kiko U e kaha iho i ke kaha UH e kaulike ana me OA. O ka huinakolu HEU he hapalua ia o ka huinahakaulike HI, a o ka huinakolu HAU he hapalua ia o ka huinahakaulike HO (Buke I. Manaohai XXVIII. Manaopili).

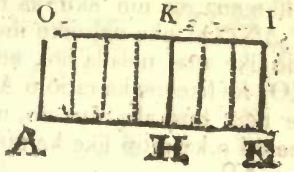
Eia hoi, ina noloko mai o ka huinahakaulike HI e hoolaweia ka huinahakaulike HO, ua koe ka huinahakaulike AI; a noloko o ka huinakolu HEU, he hapalua oia o ka huinaha mua, e hoolaweia ka huinakolu HAU, he hapalua ia o ka lua, ua koe ka huinakolu AEU he hapalua o ka huinahakaulike AI.

Manaopili. Nolaila, he hapalua ka huinakolu AEU o ka huinahaloa AEKL, no laua ke kahamoe hookahi AE, a me ke kiekie hookahi AL: no ka mea, ua waiwai like ka huinahaloa AEKL me ka huinahakaulike AI (Manaohai I. Manapili.).

Manaopili 2. Ua waiwai like na huinakolu a pau, ke like ko lakou mau kahamoe a me ko lakou mau kiekie, no ka mea, he mau hapalua lakou o na huinahakaulike i waiwai like.

MANAOHAI III.

Ina he mau huinahaloa elua, a ua like ko laua kiekie, alaila, ua like ko laua ratio kekahi i kekahi me ka ratio o ko laua mau kahamoe kekahi i kekahi.

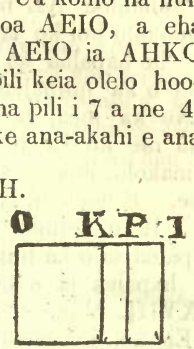


I mau huinahaloa AEIO a me AHKO, hookahi o laua kiekie AO: ua like ko laua ratio kekahi i kekahi me ka ratio o AE ia AH.

E manao mua, ua loaa kekahi

ana-akahi e ana pono ai ia laua, a ua like laua kekahi i kekahi me ka 7 i ka 4. Ina i maheleia AE i ehiku hakina like, alaila, ua komo eha o iá mau hakina iloko o AH: ma kela kiko keia kiko o ka mahele ana, e kukulu i kaha kupono i ke kahamoe; a ua hanaia malaila ehiku huinahaloa hakina, a ua like loa kekahi me kekahi, no ka mea ua like ko lakou mau kahamoe a me ko lakou mau kiekie. Ua komo na huinahaloa hakina ehiku iloko o ka huinahaloa AEIO, a eha hoi iloko AHKO; nolaila, ua like ka ratio o AEIO ia AHKO me 7 i 4, oia no me AE ia AH. A ua pili keia olelo hoomaopopo i kekahi ratio e ae, e like me kona pili i 7 a me 4; nolaila, ma kela ratio keia ratio, ina ua loaa ke ana-akahi e ana pono ai ia laua, ua loaa keia ia kakou.

AEIO : AHKO : : AE : AH.



E manao alua, aole i loaa ke ana-akahi e una pono ai ia AE, AH; ke hoike nei, kakou ua loaa mau no

AEIO : AHKO : : AE : AH.

No ka mea, i ole pela, ina he oia mau na kuaniti mua ekolu, alaila, he nui ae, a he uuku iho paha ka ha ia AH. Ma ka manao, i nui paha, alaila, ua loaa mai ia kakou.

AEIO : AHKO : : AE : AM.

E mahele i ke kaha AE i mau hakina like, i uuku iho kela hakina keia hakina ia HM.

E loaa no kekahi kiko N o keia mahele ana mawaena o H a me M: mai keia kiko N e kaha i ke kaha NP e kupono ana ia AN: ua loaa ke ana-akahi e ana pono ai i na kahamoe AE, AN, a nolaila, e like me ka mea i hoakakaia maluna, ua loaa

AEIO : ANPO : : AE : AN.

Aka ma ka manao wale, ua loaa.

AEIO : AHKO : : AE : AM.

Ma keia mau ratio elua, ua like na hiki mua; nolaila, ua ratio like na ukali (Buke II Manahai IV.); a malaila ua loaa

ANPO : AHKO : : AN : AM.

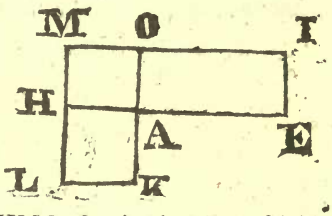
Aka ua nui aku AM ia AN; nolaila, ina he pololei keia ratio like ana, ua nui aku ka huinahaloa AHKO i ka huinahaloa ANPO: aka ua uuku iho no ia; nolaila aole e hiki keia ratio like ana; nolaila hoi, aole e hiki ka ratio o AEIO ia AHKO, ke like me ka ratio o AE i kekahi mea nui ae ia AH.

Me neia hoakaka ana no, ua maopopo, aole e hiki ka ha o na kuaniti o ka ratio like ke uuku iho ia AH: nolaila, ua like oia me AH.

Nolaila, iloko o kela ratio keia ratio o na kaha moe, ua like ka ratio o na huinahaloa elua AEIO, AHKO, i like ko laua kiekie, me ka ratio o ko laua mau kaha moe AE, AH.

MANAOHAI IV.

Ua like ka ratio o na huinahaloa elua, me ka ratio o na huinahoonui o ko laua mau kahamoe i hoonuiia e na kiekie o laua.



AEIO, AHLK na huinahaloa; alaila,
AEIO : AHLK : : AE.AO : AK. AH.

E kau mai ia mau huinahaloa, i kue na huina ma A, a e hoolohi i na aoao LH a me IO a halawai laua ma M.

O na huinahaloa AEIO, AHMO, hookahi o laua kiekie AO, nolaila ua like ko laua ratio kekahi i kekahi me ka ratio o ko laua mau kahamoe AE, AH: pela hoi, hookahi kiekie AH o na huinahaloa AKLH, AHMO, nolaila ua like ko laua, ratio kekahi i kekahi me ka ratio o ko laua mau kahamoe AK, AO: malaila ua loaa keia mau ratiolike elua,

AEIO : AHMO : : AE : AH
AHMO : AHLK : : AO : AK

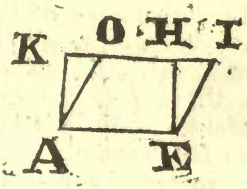
E hoonui i na kuaniti ku like o keia mau ratiolike, e ike ana no nae he pono ke waiho i ke kuaniti AHMO, no ka mea he hoonui oia ma ka hikimua a ma ka ukali no hoi, a ua loaa

AEIO : AHLK : : AE × AO : AH × AK.

He Wehewehe. Nolaila, he pono ke hoolilo i ka huinahoonui o ke kahamoe a me ke kiekie i ana o ka huinahaloa.

MANAOHAI V.

Ua like ka area o ka huinahakaulike me ka huinahoonui o kona kahamoe me kona kiekie.



No ka mea, ua waiwai like ka huinahakaulike AEIO me ka huinahaloa AEHK, hookahi ko laua kahamoe AE, a hookahi ko laua kiekie EH (Maohai I. Manaopili): aka ua anaia keia huinahaloa e AE × EH (Manaohai IV. Wehewehe.). nolaila ua like AE× EH me ka area o ka huinahakaulike AEIO.

Manaopili. Ua like ka ratio o na huinahakaulike, hookahi ko lakou kahamoe, me ka ratio o ko lakou mau kiekie: a i hookahi ko lakou kiekie, ua like ka ratio o na huinahakaulike me ka ratio o ko lakou mau kahamoe: no ka mea, ma A ke kahamoe hookahi, a I a me O na kiekie, alaila.

$$A \times I : A \times O :: I : O$$ (Buke II Manaohai VII.).

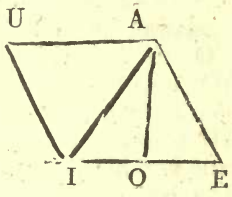
A ina A a me E na kahamoe, a o I ke kiekie hookahi, alaila ua loaa

$$A \times I : E \times I :: A : E.$$

A ua like ka ratio o na huinahakaulike me ka ratio o na huinahoonui o na kahamoe a me na kiekie o lakou.

MANAOHAI VI.

Ua like ka area o ka huinakolu me ka huinahoonui o kona kahamoe me ka hapalua o kona kiekie.



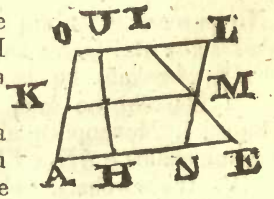
No ka mea, o ka huinakolu AEI he hapalua ia o huinahakaulike AEIU, hookahi o laua kahamoe EI, a hookahi o laua kiekie AO (Manaohai II.); aka ua like ka area o ka huinahaloa me EI×AO; nolaila, ua like ka area o ka huinakolu me ka hapalua o EI×AO, oia no EI× $\frac{1}{2}$ AO.

Monaopili. Ua like ka ratio o na huinakolu elua, hookahi o laua kiekie, me ka ratio o ko laua kahamoe: a ua like ka ratio o na huinakolu elua, hookahi o laua kahamoe, me ka ratio o ko laua kiekie.

A ua like ka ratio o na huinakolu kekahi i kekahi, me ka ratio o na huinahoonui o na kahamoe me na kiekie o lakou.

MANAOHAI VII.

Ua like ka area o ka huinahalualike me ka huinahoonui o kona kiekie me ka hapalua o ka houluulu ana o kona mau kahamoe kaulike.



I huinahalualike AEIO, AE a me OI kona mau kahamoe kaulike, UH kona kiekie; alaila, ua like kona area me UH × $\frac{1}{2}$ (AE + OI).

Maloko o M ke kikowaena o ka aoao IE e kaha i ke kaha LN e kau like ana me ka aoao kue AO; a e hooloihi ia OI a halawai ia me NL.

Iloko o na huinakolu MNE, MIL, ua loaa ka aoao ME = MI ma ka hana ana: o ka huina NME = IML; a no ke kaulike ana o NE a me IL, ua like ka huina MEN me MIL (Buke I. Manaohai XX. Manaopili 2.); nolaila, ua like ia mau huinakolu (Buke I. Manaohai VI.); nolaila, ua waiwai-like ka huinahalualike AEIO me ka huinahakaulike ANLO, a ua anaia e UH × AN.

Aka ua loaa ia kakou AN = OL: a no ka like ana o na huinakolu MEN, MLI, ua like ka aoao NE me IL: nolaila, AE + OI = AN + OL = 2 AN; nolaila, he hapalua AN o ka houluulu ana o na aoaomoe AE, OI; nolaila hoi, ua like ka area o ka huinahalualike AEIO me ka huinahoonui o ke kiekie UH me ha hapalua o ka houluulu ana o na kahamoe AE, OI, a ua hoikeia penei;

$$\text{AEIO} = \text{UH} \times \frac{\text{AE}+\text{OI}}{2}.$$

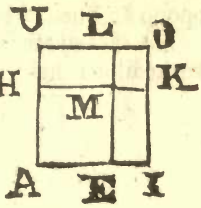
He Wehewehe. Ina moloko o M ke kikowaena o IE e kahaia ke kaha MK e kaulike ana me AE, alaila, e kau no ke kiko K mawaenakonu o OA. No ka mea, he mau huinahakaulike AKMN, a me OKML, e kaulike ana na aoao kue o laua, malaila ua loaa ia kakou AK = MN, OK = ML; aka no ka like ana o na huinakolu EMN, IML ua loaa MN = ML; nolaila AK = KO.

He pono hoi ke oleloia, ke kaha $\text{KM} = \text{AN} = \frac{\text{AE}+\text{OI}}{2}$, nolaila, he pono ke hoikeia ka area o ka huinahalualike e UH × KM; nolaila, ua like oia me ke kiekie o ka huinahalualike i hoonuiia me ke kaha e hui ana i na kikowaena o kona mau aoao hio.

MANAOHAI VIII.

Ina i okiia kekahi kaha i elua apana, alaila, ua waiwai like ka huinahalike i kauia maluna o ke kaha okoa, me ka houluulu ana o na huinahalike i kauia maluna o kela apana keia apana e hui ia hoi me ka palua o ka huinahaloa o na apana.

AI ke kaha okiia ma ke kiko E; alaila AI^2 oia no $(\text{AE} + \text{EI})^2 = \text{AE}^2 + \text{EI}^2 + 2\,\text{AE} \times \text{EI}$.



E kau i ka huinahalike AIOU; e lawe ia AH = AE; e kaha ia HK e kaulike ana me AI, a ia EL e kaulike ana me AU.

Iloko o ke kuea AIOU eha mau apana; o ka mua AEMH o ke kuea no ia e

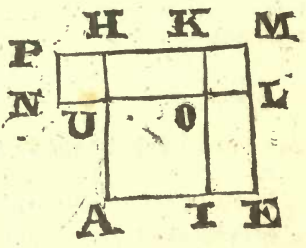
kauia maluna o AE, no ka mea, ua hana kakou ia AH = AE: o ka lua MKOL o ke kuea no ia e kauia maluna o MK oia no EI, no ka mea, ua loaa AI = AU, AE, = AH, nolaila AI — AE = AU — AH, oia no EI = HU; aka ua like MK me EI, a ua like ML me HU no ke kaulike ana o na kaha; nolaila, ua like MKOL me ke kuea e kauia maluna o EI, a i laweia keia mau kuea elua noloko aku o ke kuea okoa, ua koe na huinahaloa elua MKIE a me UHML a ua anaia kekahi a me kekahi o laua e AE × EI: nolaila, ua maopopo, ua waiwailike ke kuea nui me na kuea uuku iho elua i huiia me keia mau huinahaloa elua.

Manaopili. Ina e okiia ke kaha AI i mau apana like, alaila, ua lilo na huinahaloa UM, MI, i mau kuea, a ua like ke kuea o ke kaha okoa me na kuea eha o ka hapalua o ke kaha.

He Wehewehe. Ua like keia pono me ka pono i wehewe-heia iloko o ka *hoailona helu*, ma ka imi ana i ke kuea o na hua elua ka i kakauia penei $(a + e)^2 = a^2 + 2ae + e^2$.

MANAOHAI IX.

O ke kuea i kauia maluna o ka like ole o na kaha elua, ua waiwailike ia me ka houluulu ana o na kuea i kauia maluna o ia mau kaha, i hoemiia e ka papalua ana o ka huinahaloa o ia mau kaha.



AE a me EI na kaha elua, AI ko laua like ole: alaila AI^2 oia no $(AE — EI)^2 = AE^2 + EI^2 — 2\,AE \times EI$.

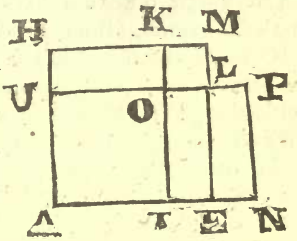
E kau i ke kuea AEMH; e lawe ia AU = AI: e kaha ia UL e kaulike ana me AE, a me IK e kaulike ana me EM, a e hana i ke kuea UHPN.

O na huinahaloa alua KIEM a me KPNO, ua anaia kekahi a me kekahi e AE × EI; e lawe ia laua noloko aku o ke kii okoa AEMPNUA = $AE^2 + EI^2$, alaila ua koe maopopo ke kuea AIOU, nolaila ua oiaio ka manaohai.

He Wehewehe. Ua like keia manaohai me kakahi hana a ka hoailona helu, penei, $(a — e)^2 = a^2 — 2ae + e^2$.

MANAOHAI X.

O ka huinahaloa i hanaia e ka houluulu ana, a me ka like ole ana o na kaha elua, ua waiwailike oia me ka like ole o na kuea o ia mau kaha.



AE a me EI na kaha elua, alaila $(AE + IE) \times (AE - IE) = AE^2 - IE^2$.

Maluna o AE a me AI e kau i na kuea AEMH, AIOU; hoolohi ia AE a like EN me EI, a e hoopa i ka huinahaloa ANPU.

O ke kahamoe AN o ka huinahaloa UN o ka houluulu ana no ia o na kaha elua AE a me EI: o kona kiekie AU oia no ka like ole o ia mau kaha elua; nolaila, o ka huinahaloa ANPU $= (AE + EI) \times (AE - EI)$. Aka iloko o keia huinahaloa ua apana AELU a me ENPL: a o ka apana ENPL ua like oia me ka huinahaloa HUOK, no ka mea, ua like EL me UO, a ua like EN me HU: nolaila, ua like ANPU me AELU+HUOK. O keia mau apana elua o AELU + HUOK o ke kuea no ia o AEMH ke hoolaweia ke kuea OLMK, o ka like ia o ke kuea e kauia maluna o EI; nolaila, ua loaa

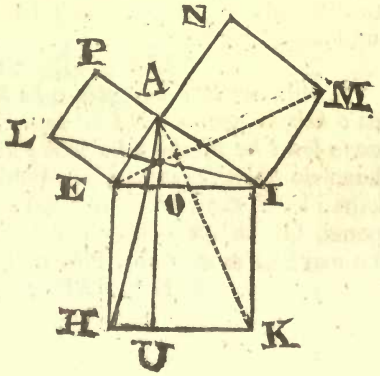
$$(AE + EI) \times (AE - EI) = AE^2 - EI^2.$$

He Wehewehe. Ua like keia manaohai me kekahi hana a ka hoailona helu, penei,

$$(a + e) \times (a - e) = a^2 - e^2.$$

MANAOHAI XI.

Iloko o ka huinakolukupono, ua waiwai like ke kuea e kauia maluna o ka aoao loa me ka houluulu ana o na kuea o na aoao elua i koe.



AEI ka huinakolukupono, ma A ka huinakupono. E kau iho i na kuea maluna o na aoao ekolu.

E kau iho mai A aku i ke kaha AU e kupono ana ia EI ka aoao loa; a e kaha iho i na kaha kapakahi AH, IL.

Iloko o ka huina AEH ka huina AEI a me ka huinakupono IEH;

iloko o ka huina LEI o ua huina la AEI a me ka huinakupono AEL; nolaila, ua like ka huina AEH me LEI. Aka, ua loaa ia kakou AE = EL he mau aoao o ke kuea hookahi, a o EH = EI he mau aoao o ke kuea hookahi no hoi: nolaila, ua loaa i na huinakolu AEH, LEI, na aoao elua a me ka huina mawaena o kekahi like me ko kekahi; nolaila, ua like ia mau huinakolu (Buke I. Manaohai V.).

O ka huinakolu AEH he hapalua oia o ka huinahaloa EU, no ka mea hookahi o laua kaha moe EH, a hookahi hoi o laua kiekie EO (Manaohai II. Manaopili I.). O ka huinakolu LEI he hapalua oia o ke kuea AL; no ka mea, hookahi kaha poloiei na kaha AI a me AP e kau like ana me EL no ke kupono o na huina EAI, EAP (Buke I. Manaohai III.); a nolaila, o ka huinakolu LEI a me ke kuea LEAP, hookahi o laua kahamoe LE a hookahi o laua kiekie AE, a nolaila he hapalua ka huinakolu o ke kuea.

Ua hoikeia ka huinakolu EHA = ELI; nolaila, ua waiwailike ka huinahaloa EU, ka i papalua i ka huinakolu AEH, me ke kuea AL ka i papalua i ka huinakolu LEI. Peia hoi, ua hiki ke hoikeia ka huinahaloa OUKI = ke kuea AM.

Aka o na huinahaloa elua EHUO, OUKI i hui pu ia, oia no ke kuea EIKH: nolaila, o ke kuea EIKH i kauia maluna o ka aoaoloa EI, ua waiwailike oia me ka houluulu ana o na kuea AELP, AIMN i kauia maluna o na aoao e ae elua; oia no keia,

$$EI^2 = AE^2 + AI^2.$$

Manaopili I. Nolaila, ua waiwailike ke kuea o kekahi aoao o ka huinakolukupono, me ke kuea o ka aoaoloa i hoemiia e ke kuea o kekahi aoao: penei keia e hoikeia,

$$AE^2 = EI^2 - AI^2.$$

Manaopili 2. Ua hoikeia, ua waiwailike ke kuea AL me ka huinahaloa EHUO; aka no ka hookahi ana o ke kiekie EH, ua like ka ratio o ke kuea EIKH i ka huinahaloa EHUO me ka ratio o ka aoao moe EI i ka aoao moe EO; nolaila ua loaa

$$EI^2 : AE^2 :: EI : EO.$$

Nolaila *ua like ka ratio o ke kuea o ka aoao loa i ke kuea o kekahi aoao i pili i ka huinakupono, me ka ratio o ka aoao loa i ka apana i ku mai i kela aoao.* Ke hoike mai ka huaolelo *apana* maanei i kela pauku o ka aoaoloa i okiia e ke kaha i kuuia mai ka huinakupono e kupono ana i ka aoaoloa: penei, OI ka apana i ku mai i ka aoao AI; EO ka apana i ku mai i ka aoao AE. Pela no hoi ua loaa mai

$$EI^2 : AI^2 :: EI : OI.$$

Manaopili 3. Hookahi kiekie o na huinahaloa EOUH OIKU, nolaila, ua like ko laua ratio, me ka ratio o ko laua mau kahamoe EO, OI. Aka ua waiwailike keia mau huinahaloa me na kuea AL, AM; nolaila ua loaa mai

$$AE^2 : AI^2 :: EO : OI.$$

Nolaila ua like ka ratio o na kuea o na aoao elua e hoopa ana i ka huinakupono kekahi i kekahi, me ka ratio o na apana o ka aoaoloa i ku mai i kela mau aoao.

Manaopili 4. I kuea AEIO, AI, kona kaha kapakahi: o ka huinakolu AEI he huinakolu kupono ia, a he huinakolu eluaaoaolike, malaila ua loaa

$$AI^2 = AE^2 + EI^2 = 2\,AE^2.$$

Nolaila *ua papalua ke kuea e kauia maluna o ke kaha kapakahi* AI *i ke kuea e kauia maluna o ka aoao* AE.

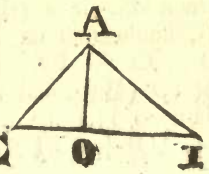
E maopopo ae keia ma ke kaha ana i na kaha ma na kiko A a me I e kaulike ana me OE, a ma na kiko E a me O e kaulike ana me AI. Pela ua hanaia kekahi kuea hou, a ua like oia me ke kuea o AI. Eia hoi, iloko o UHKL na huinakolu ewalu, a ua like kela huinakolu keia huinakolu o lakou a pau me AUE; a iloko o AEIO eha o ia mau huinakolu: nolaila ua papalua UHKL ia AEIO.

Eia hoi ua loaa ia kakou $AI^2 : AE^2 :: 2 : 1$; e unuhi i na kumukaha o keia ratio like, a ua loaa mai $AI : AE :: \sqrt{2} : 1$; nolaila, *o ke kahakapakahi o ke kuea a me kekahi aoao, aole i loaa ke ana-akahi e ana pono ai ia laua*; e wehewehe hou ia uanei keia, a nui aku ka maopopo.

MANAOHAI XII.

Iloko o na huinakolu a pau, ua uuku iho ke kuea o ka aoao kue i ka huina oi, i ka houluulu ana o na kuea o na aoao elua e ae: eia ka like ole, o ka palua ana o ka huinahaloa o ka aoaomoe a me ka loa mai ia huina oi a hiki i ke kahakupono i kuuia mai ka huinakue i ke kahamoe a ke kahamoe, a i ke kahamoe i hooloihiia paha.

AEI ka huinakolu, AO ke kahakupono i ke kahamoe EI; alaila,



$$AE^2 = AI^2 + EI^2 - 2\,EI \times IO.$$

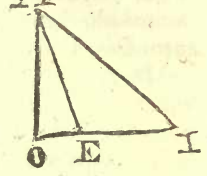
Alua hana ana.

Akahi. Ke haule ke kahakupono maloko o ka huinakolu AEI, malaila

ua loaa mai EO = EI — OI, a nolaila $EO^2 = EI^2 + OI^2 - 2\ EI \times IO$ (Manaohai IX.).

E hui pu ia AO^2 me kela aoao keia aoao o keia like ana, a ua loaa mai $EO^2 + AO^2 = OI^2 + AO^2 + EI^2 - 2\ EI \times IO$ (Akioma 2.).

Aka he mau huinakolukupono AEO, AIO, nolaila $AE^2 = EO^2 + AO^2$, a o $AI^2 = OI^2 + AO^2$ (Manaohai XI.): nolaila hoi $AE^2 = AI^2 + EI^2 - 2\ EI \times IO$.



Alua. Ke haule ke kahakupono AO mawaho o ka huinakolu AEI, malaila ua loaa EO = IO — EI; a nolaila $EO^2 = IO^2 + EI^2 - 2IO \times EI$ (Manaohai IX.).

E hui pu ia AO^2 me kela aoao keia aoao o ka like ana, a ua loaa $AO^2 + EO^2 = AO^2 + IO + EI^2 - 2IO \times EI$.

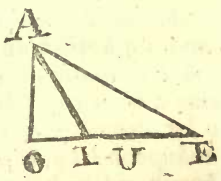
$AE^2 = AO^2 + OE^2$, a $AI^2 = AO^2 + OI^2$, nolaila hoi $AE^2 = AI^2 + EI^2 - 2\ IO \times EI$.

MANAOHAI XIII.

Iloko o na huinakolu peleleu a pau, ua nui aku ke kuea o ka aoao kue i ka huinapeleleu, i ka houluulu ana o na kuea o na aoao elua e ae; eia ka likeole, o ka palua o ka huinahaloa o ke kahamoe a me ka loa mai ka huinapeleleu, a hiki i ke kaha kupono i kuuia mai ka huina kue i ke kahamoe, a i ke kahamoe i hooloihiia.

AIE ka huinakolu, I ka huinapeleleu, AO ke kahakupono ia EI i hooloihiia; alaila,

$AE^2 = AI^2 + EI^2 + 2\ EI \times IO$



Aole hiki ke kahakupono ke haule maloko o ka huinakolu, no ka mea, ina i haule mai oia ma kekahi kiko me U, alaila, ua loaa, iloko o ka huinakolu AIU, ka huinakupono U, a me ka huinapeleleu I, he mea hiki ole ia (Buke I. Manaohai XXV. Manaopili 3.): nolaila, haule mai ua kaha kupono mawaho; a ua loaa,

EO = EI + IO. Nolaila hoi $EO^2 = EI^2 + IO^2 + 2EI \times IO$ (Manaohai VIII.). E hui pu ia AO^2 me kela aoao keia aoao o ka like ana, a ua loaa $EO^2 + AO^2 = EI^2 + IO^2 + AO^2 + 2\ EI \times IO$: no ke kupono o na huinakolu

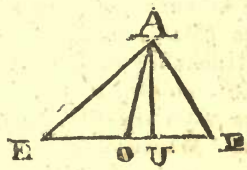
AOE, AOI, ua loaa $AE^2 = EO^2 + AO^2$, a $AI^2 = IO^2 + AO^2$; nolaila hoi ua loaa

$$AE^2 = EI^2 + AI^2 + 2\,EI \times IO.$$

He Wehewehe. Iloko o ka huinakolu kupono wale no, ua waiwailike ka houluulu ana o na kuea o na aoao elua, me ke kuea o ke kolu: no ka mea, ina he huina oi mawaena o ia mau aoao elua, alaila, ua nui aku ka houluulu ana o na kuea o laua i ke kuea o ke kolu: a ina he peleleu, ua uuku iho.

MANAOHAI XIV.

Iloko o ka huinakolu, ina i kahaia ke kaha mai ke kihi mai a i ke kikowaena o ke kahamoe, alaila, o ka palua o ke kuea o keia kaha i huiia me ka palua o ke kuea o ka hapalua o ke kahamoe, ua waiwailike oia me ka houluulu ana o na kuea o na aoao e ae elua o ka huinakolu.



I huinakolu AEI, AO ke kaha i kahaia mai ke kihi A, a i ke kikowaena O o ke kahamoe EI: alaila, $2\,AO^2 + 2\,EO^2 = EA^2 + AI^2$.

Maluna mai o EI e kuu iho i ke kahakupono AU. Alaila ma ka Manaohai XII.

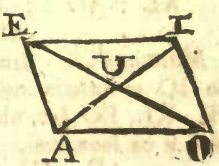
$$AI^2 = AO^2 + OI^2 - 2\,OI \times OU$$

A ma ka manaohai XIII. hoi,

$$AE^2 = AO^2 + EO^2 + 2\,EO \times OU.$$

Nolaila, ma ka houluulu ana i keia me kela, e hoomaopopo ana hoi ua like EO me OI, ua loaa mai $AE^2 + AI^2 = 2\,AO^2 + 2\,EO^2$.

Manaopili. Nolaila, iloko o na huinahakaulike a pau, ua waiwailike ka houluulu ana o na kuea o na aoao, me ka houluulu ana o na kuea o na kahakapakahi.



Ua oki na kahakapakahi AI a me EO kekahi i kekahi mawaenakonu (Buke I. Manaohai XXXI.); nolaila, ma ka huinakolu AEI ua loaa,

$$AE^2 + EI^2 = 2\,AU^2 + 2\,EU^2.$$

Pela hoi ma ka huinakolu AOI ua loaa

$$AO^2 + OI^2 = 2\,AU^2 + 2\,OU^2$$

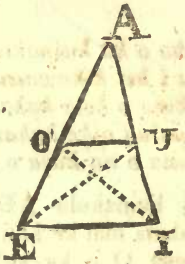
E houluulu i keia mau like ana, e hoomaopopo ana hoi ua like EU me OU, a ua loaa,

$$AE^2 + AO^2 + OI^2 + IE^2 = 4\,AU^2 + 4\,OU^2$$

Aka 4 AU^2 o ke kuea no ia o 2 AU=AI: a 4 OU_2 oia no ke kuea o 2 OU = EO (Manaohai VIII. Manaopili): nolaila, ua waiwailike na kuea o na aoao i houluuluia, me na kuea o na kahakapakahi.

MANAOHAI XV.

Ina i kahaia ke kaha i kaulike me ke kahamoe o ka huinakolu, alaila, ua oki ratiolike oia i na aoao e ae.



I huinakolu AEI, a i kaha pololei OU e kaulike ana me ke kahamoe EI: a laila,

AO : OE : : AU : UI.

E kaha ia EU, OI. Hookahi kaha moe OU o na huinakolu EOU, OUI; a hookahi hoi kiekie o laua, no ka mea, ke moe la ko laua mau kihi ma ke kaha kaulike me ke kaha moe, nolaila, ua waiwailike laua (Manaohai II. Manaopili 2.).

Hookahi kihi U o na huinakolu AOU, EOU, nolaila, hookahi o laua kiekie, nolaila, hoi, ua like ko laua ratio kekahi i kekahi me ka ratio o na kahamoe o laua (Manaohai VI. Manaopili.): malaila ua loaa,

AOU : EOU : : AO : OE.

Hookahi kihi O o na huinakolu AOU, UOI, nolaila, hookahi o laua kiekie, a nolaila, ua like ko laua ratio kekahi i kekahi me ka ratio o ko laua mau kahamoe; nolaila,

AOU : OUI : : AU : UI.

Aka ua waiwailike na huinakolu EOU, OUI, a nolaila, ua loaa (Buke II. Manaohai IV. Manaopili),

AO : OE : : AU : UI.

Manaopili 1. Nolaila, ma ka hui ana (Buke II, Manaohai VI), ua loaa,

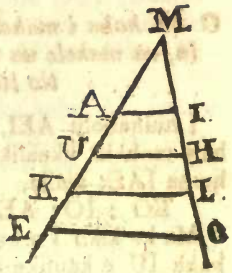
AO + OE : AO : : AU + UI : AU. oia no keia

AE : AO : : AI : AU; a ua loaa hoi,

AE : EO : : AI : IU.

Manaopili 2. Ina iwaena o na kaha pololei elua AE a me IO e kahaia na kahakaulike, a lehulehu paha, me AI, UH, KL, EO &c, alaila, ua oki ratiolike ia o ia mau kaha pololei, a ua loaa mai,

AU : IH : : UK : HL : : KE : LO.



No ka mea, e hooloihi ia mau kaha pololei AE a me IO a halawai laua ma ke kiko M. Iloko o ka huinakolu MUH, ua kahaia ke kaha AI e kaulike ana me ke kahamoe UH, nolaila,

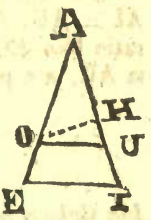
MU : AU :: MH : IH, a

MU : MH :: AU : IH. Iloko o ka huinakolu MKL, ua loaa hoi, MU : UK :: MH : HL, a MU : MH :: UK : HL. A ma ka ratiolike hookahi MU : MH o keia mau ratiol ke, ua loaa mai AU : IH :: UK : HL.

Pela hoi e hiki ai ke hoomaopopoia UK : HL :: KE : LO, a pela aku no; nolaila, ua oki ratiolike ia na kaha pololei AE a me IO e na kahakaulike AI, UH, KL, EO, a ia kahakaulike aku, ia kahakaulike aku.

MANNOHAI XVI.

Ina i oki ratiolike ia na aoao elua o ka huinakolu e kekahi kaha pololei, alaila, ua kaulike ua kaha pololei nei me ka aoao akolu.



Iloko o ka huinakolu AEI, e kaha ia OU e oki ana ia AE a me AI i ratiolike, penei, AO : OE :: AU : UI; alaila, ua kaulike OU me EI.

No ka mea, ina aole i kaulike OU me EI, e kaha ia OH e kaulike ana me ia.

Alaila, ma ka manaohai maluna ae nei, ua loaa

AO : OE :: AH : HI. Aka ma ka olelo mua ua loaa AO : OE :: AU : UI; nolaila, ua loaa hoi

AH : HI :: AU : UI, oia no AH : AU :: UI : HI; he mea hiki ole ia, no ka mea, o kekahi hikimua AH ua uuku iho ia i ka ukali AU, o kela hikimua HI ua nui aku ia i kona ukali UI. Nolaila, o ke kaha kaulike me EI i kahaia mai ke kiko O aku, aole hiki ia ke kaawale ae ia OU; nolaila, ua kaulike OU me EI.

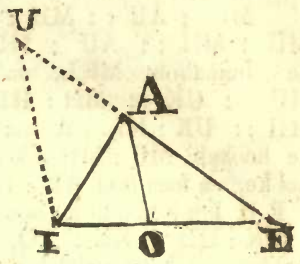
He Wehewehe. Pela no hoi ka maopopo, ina penei ka ratiolike ana AE : AO :: AI : AU.

No ka mea, noloko mai o keia like ana, ua loaa AE — AO : AO :: AI — AU : AU, oia no,

OE : AO :: UI : AU.

MANAOHAI XVII.

O ke kaha i mahele likealike i ka huina kihi o ka huinakōlu, ua mahele ua kaha la i ke kahamoe i mau apana ratio like me ka ratio o na aoao pili.



I huinakolu AEI, AO ke kaha e mahele likealike ana i ka huina IAE; alaila,

EO : IO : AE : : AI.

Ma ke kiko I e kaha aku i ke kaha IU e kaulike ana me AO, a halawai oia me EA i hooloihiia.

Iloko o ka huinakolu EIU, ua kaulike ke kaha AO me ke kahamoe IU; nolaila, ua loaa ka ratiolike ana (Manaohai XV.),

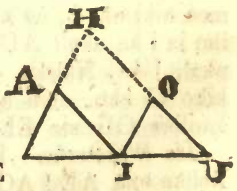
EO : OI : : AE : AU.

Aka o ka huinakolu AIU, he huinakolu elua aoao like oia: no ka mea, ma ke kau like ana o AO a me UI ua loaa ka huina AIU = OAI, a me ka huina AUI = EAO, (Buke I. Manaohai XX. Manaopili 2 a me 3.); aka ma ka olelo mua OAI = EAO; nolaila, o ka huina AIU = AUI, a nolaila hoi, AI = AU, (Buke I. Manaohai XII.). Ua loaa maluna ka ratio like EO : OI : : AE : AU, noloko aku o keia e lawe ia AU, a e pani i kona hakahaka me AI kona like, a ua loaa

EO : OI : : AE : AI.

MANAOHAI XVIII.

Ina iloko o na huinakolu elua ua like na huina o kekahi me ko kekahi, alaila, ua ratiolike na aoao homoloko, a ua ano like hoi ia mau huinakolu.



I mau huinakolu AEI, IOU i like na huina o kekahi me ko kekahi, oia no ka huina EAI = IOU, AEI = OIU, AIE = OUI; alaila ua ratio like na aoao homoloko, oia no na aoao kue i na huina like, a e loaa malaila,

EI : IU : : AE : OI : : AI : OU.

E hoonoho pu i na aoao homoloko EI, IU, iloko o ke kaha pololei hookahi: a e hooloihi ia EA, a me UO, a halawai laua ma ke kiko H.

He kaha pololei ke kaha EIU, a ua like ka huina EIA me ka huina IUO, nolaila, ua kaulike AI, me OU, (Buke I. Manaohai XIX. Manapili 2.). Pela hoi, no ka like ana o ka huina AEI, me ka huina OIU, ua kaulike AE, me OI. Nolaila, o ke kii AIOH, he huinahakaulike oia.

Iloko o ka huinakolu EHU, ua kaulike ke kaha AI, me ke kahamoe HU, malaila ua loaa EI : IU : : EA : AH, (Manaohai XV.); e lawe ia AH, a e pani iho i kona hakahaka me IO, kona like, a ua loaa EI : IU : : EA : IO.

Iloko o ia huinakolu EHU, ua kaulike ke kaha IO, me ke kahamoe EH, malaila ua loaa EI : IU : : HO : OU e hookomo ia AI, i ka wahi o kona like HO, a ua loaa

EI : IU : : AI : OU.

Eia hoi, no ke komo ana o ka ratio hookahi EI : IU, iloko o keia mau ratio like, ua loaa ia kakou keia,

AI : OU : : EA : IO.

Peia, iloko o na huinakolu elua AEI, OIU, i like na huina o kekahi me ko kekahi, ua ratiolike na aoao homoloko. Aka o na kii elua i like na huina o kekahi me na huina o kekahi, kekahi me kekahi, a i ratiolike ko laua mau aoao homoloko, ua ano like laua (Hoak. I.); nolaila, ua ano like na huinakolu AEI, OIU, i like na huina o kekahi me ko kekahi.

Manaopili. Ua maopopo ke ano like o na huinakolu elua, ke like na huina elua o kekahi me na huina elua o kekahi, kekahi me kekahi; no ka mea, malaila ua like hoi ke kolu o keia me ke kolu o kela; a o ia mau huinakolu elua; ua like na huina o kekahi me ko kekahi.

He Wehewehe. E ike pono, iloko o na huinakolu ano like, ke kue nei na aoao homoloko i na huina like; penei ua like ka huina AIE, me OUI, a o ka aoao AE, ua homoloko oia me OI; pela hoi ua homoloko AI, me OU, no ko laua kue ana i na huina like AEI, OIU.

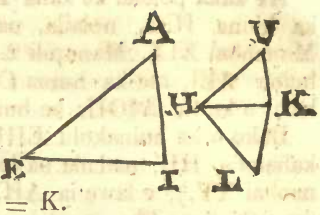
Aia i maopopo na aoao homoloko, ua hiki wawe na ratio like:

AE : OI : : AI : OU : : EI : IU.

MANAOHAI XIX.

Ua like na huina o na huinakolu elua, ko kekahi me ko kekahi, a ua anolike laua, ke ratio like na aoao homoloko o laua.

Iloko o na huinakolu elua AEI, UHK, ua hoikeia,
EI : HK :: AE : UH ::
AI : UK;
alaila, ua like na huina o na huinakolu AEI, UHK, ko kekahi me ko kekahi, oia no ka huina A = U, E = H, I = K.



Ma ke kiko H e hana i ka huina KHL = E, a ma ke kiko K e hana i ka huina HKL = I, ua like ke kolu o na huina L me ke kolu A, a ua huinalike ia mau huinakolu elua AEI, HKL, (Buke I. Manaohoi XXV. Manaopili 2.). Nolaila, ma ka manaohai hope iho nei, ua loaa EI : HK :: AE : HL; aka ma ka olelo mua,

EI : HK :: AE : HU; nolaila, HL = HU.

Ma ia manaohai no hoi ua loaa,

EI : HK :: AI : KL; a ma ka olelo mua,

EI : HK :: AI : KU; nolaila, KL = KU

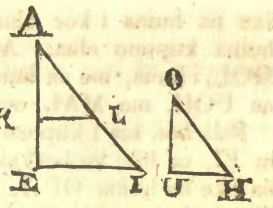
Nolaila, iloko o ia mau huinakolu HKU, HKL, ua like na aoao ekolu o kekahi me ko kekahi, nolaila, ua like laua (Buke I. Manaohai X.). Aka, ma ka hana ana, ua huinalike na huinakolu AEI, HKL: nolaila, ua huinalike a ua ano like na huinakolu AEI, UHK.

He Wehewehe 1. Ma neia mau manaohai elua hope iho nei, ua ikea keia, iloko o na huinakolu, ina he ratiolike na aoao, alaila, ua like na huina; a ina he like na huina, alaila, ua ratiolike na aoao. Aole pela iloko o na kii i nui aku na aoao i ke kolu; iloko o na huinaha, e hiki no ke hoololi ae i ka ratio o na aoao, me ka loli ole o na huina; a e hiki hoi ke hoololi ae i na huina, a e ku oia mau ka ratio o na aoao.

He Wehewehe 2. O keia mau manaohai elua maluna aku nei, hookahi ano nui o laua, a o laua pu me ka Manaohai XI e pili ana i ke kuea o ka aoao loa, na mea e hua nui mai ana iloko o ka anahonua: ua ane hiki ia lakou wale no ke wehewehe i na pilikia o na nanehai a pau. No ka mea, ua hiki i na kii a pau ke maheleia i mau huinakolu, a ua hiki i kela huinakolu keia huinakolu ke maheleia i elua huinakolu kupono; nolaila, eia no iloko o ka huinakolu na ano o na kii a pau.

MANAOHAI XX.

Ua anolike na huinakolu elua, ke like kekahi huina o kekahi me kekahi huina o kekahi, a ke ratiolike hoi na aoao e pāa ana ia mau huina like.

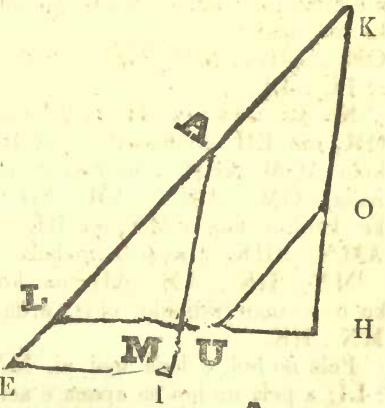


Iloko o na huinakolu elua AEI, OUH, i like na huina A a me O; alaila ina AE : OU :: AI : OH, ina ua anolike ia mau huinakolu. E lawe ia AK = OU. a e kaha ia KL, e kaulike ana me EI. Ua like ka huina AKL, me AEI (Buke I. Manaohai XX. Manaopili 3.); a ua huinalike na huinakolu AKL, AEI, kekahi me kekahi; nolaila, ua loaa,

AE : AK : : AI : AL. Aka ma ka olelo mua AE : OU :: AI : OH; a ma ka hana ana AK = OU; nolaila, AL = OH. Ua loaa i na huinakolu elua AKL, OUH, kekahi huina like iwaena o na aoao like, nolaila, ua like laua: aka ua anolike ka huinakolu AKL, me AEI, nolaila, ua anolike OUH, me AEI.

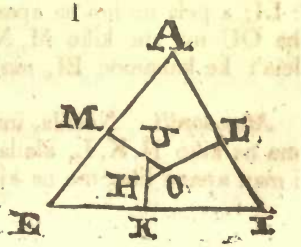
MANAOHAI XXI.

Ua anolike na huinakolu elua, ke kaulike na aoao hoomoloko, a ke kupono paha na aoao homoloko kekahi i kekahi.



I elua huinakolu AEI, OUH.

Akahi. ina i kaulike ka aoao AE, me OU, a EI, me UH. alaila, ua like ka huina AEI, me OUH, (Buke I. Manaohai XXIV.); ina i kaulike AI, me OH, alaila, ua like ka huina AIE me OHU, a ua like hoi EAI, me UOH; nolaila, ua hunalike na huinakolu AEI OUH; a nolaila, ua anolike laua (Manaohai XVIII.).



Alua. Ina i kupono ka aoao OU, ia AE, a me ka aoao OH ia AI, alaila he mau huinakupono na huina elua M a me L o ka huinaha AMOL: aka ua like na huina eha i houluuluia me na huinakupono eha (Buke I, Manaohai XXVI, Manaopili 1.), nolaila, ua

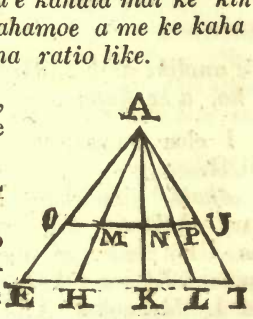
like na huina i koe elua, MAL a me MOL i huiia, me na huina kupono elua. Aka, ua like hoi na huina UOH, a me MOL, i huiia, me na huinakupono elua: nolaila, ua like ka huina UOH, me MAL, oia no EAI.

Pela hoi, ina i kupono ka aoao akolu HU, me ka aoao ekolu EI, ua hiki ke hoakakaia ua like ka huina OHU, me I, a ua like ka huina OUH, me E: nolaila, ua huinalike a ua anolike na huinakolu elua, ke kupono ko laua mau aoao homoloko kekahi i kekahi.

He Wehewehe. I ka hana ana e kaulike ana na aoao, o na aoao homoloko ka i kaulike: a i ka hana ana e kupono ana na aoao, o na aoao homoloko ka i kupono.

MANAOHAI XXII.

Iloko o ka huinakolu, ina i kahaia kekahi kaha kaulike me ke kahamoe, alaila, o na kaha a pau e kahaia mai ke kihi mai, ke mahele nei lakou i ke kahamoe a me ke kaha i kaulike me ia, i mau apana ratio like.



E kaulike OU me ke kahamoe EI, a e kaha i na kaha e ae, e like me ke kii nei; alaila,
OM : EH :: MN : HK :: NP : KL :: PU : LI.

No ka mea, no ke kaulike ana o OM, me EH, ua huinalike na huinakolu AOM, AEH; a ua loaa ia kakou ilaila, OM : EH :: AM : AH, a no ke kaulike ana o MN, me HK, ua huinalike na huinakolu AMN, AHK; a ua loaa malaila,

MN : HK :: AM : AH; ua komo ka ratio AM: AH, iloko o ia mau ratiolike elua, a ua loaa malaila OM : EH :: MN : HK.

Pela no hoi, e loaa mai ai, MN : HK :: NP : KL :: PU : LI; a pela no hoi na apana e ae: nolaila, ua maheleia ke kaha OU ma na kiko M, N, P, ma ka ratio hookahi i maheleia'i ke kahamoe EI, ma na kiko H, K, L.

Manaopili. Nolaila, ina i maheleia EI, i mau apana like ma na kiko H, K, L, alaila, ua maheleia hoi ke kaulike OU, i mau apana like, ma na kiko M, N, P.

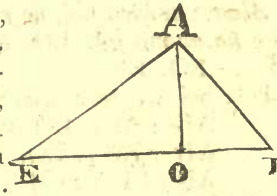
MANAOHAI XXIII.

Iloko o ka huinakolukupono, ina i kuuia, mai ka huinakupono, i kaha kupono i ka aoaoloa; alaila,

Akahi. Ua anolike na hakinahuinakolu i hanaia malaila, a ua anolike hoi laua me ka huinakolu okoa.

Alua. O kehahi aoao e paa ana i ka huinakupono, he ratiolike waena ia iwaena o ka apana pili ia ia a me ka aoaoloa.

Akolu. He ratiolike waena ke kahakupono iwaena o na apana elua o ka aoaoloa.



I huinakolu kupono AEI, AO, ke kahi kupono ia EI, ka aoaoloa.

Akahi. O ka huina E he huina ia iloko o na huinakolu EAO, EAI, a o ka huinakupono EOA = EAI, nolaila, o ke kolu o na huina EAO = AIE, (Buke I. Manaohai XXV. Manaopili 2.): n laila, ua huinalike a ua anolike na huinakolu EAI, EAO. Pela hoi ua hiki ke hoakaka iho, ua anolike na huinakolu OAI, EAI; nolaila, ua huinalike, a ua anolike ia mau huinakolu a pau.

Alua. No ke anolike ana o na huinakolu EAI, EAO, nolaila, ua ratiolike na aoao homoloko. Aka, ua homoloko EO, iloko o ka huinakolu uuku, a me EA, iloko o ka huinakolu nui, no ka mea, ke kue laua i na huina like EAO, a me AIE: ua homoloko ka aoaoloa EA, o ka huinakolu uuku, me ka aoao loa EI, o ka huinakolu nui; nolaila, ka ratiolike,

EO : EA :: EA : EI. Pela hoi ua loaa mai

OI : AI :: AI EI; : nolaila, o kela aoao keia aoao AE, AI, he ratiolikewaena ia iwaena o ka apana pili ia ia a me ka aoaoloa.

Akolu. No ke anolike ana o na huinakolu AEO, AIO, ua ratiolike na aoao homoloko o laua, a ua loaa malaila,

EO : AO : : AO :OI; nolaila, he ratiolikewaena ke kupono AO, iwaena o na apana EO, OI, o ka aoaoloa.

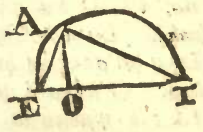
He Wehewehe. Ma ka ratiolike EO : AE :: AE : EI; ua like ka huinahoonui o na welau me ka huinahoonui o na waena, oia no keia,

$AE^2 = EO.EI$. Pela hoi ua loaa mai,

$AI^2 = IO.EI$;nolaila hoi,

$AE^2 + AI^2 = EO.EI + IO.EI = (EO + IO) \times EI = EI^2$; oia keia, ua waiwai like ke kuea o ka aoaoloa me ka he-

uluulu ana o na kuea o na aoao elua i koe. Pela ua loaa hou mai ia ano o ke kuea o ka aoaoloa i hoakakaia ma ka manaohai XI.



Manaopili. Ina mai kekahi kiko A o ka poai, e kahaia na kaula elua AE, AI, a i na welau o ke anawaena EI, alaila he huinakolu kupono ka huinakolu AEI (Buke III. Manaohai XVIII. Manaopili 2.): nolaila, *akahi, he ratiolikewaena ke kupono* AO, *mawaena o na apana* EO OI, *o ke anawaena,* oia no keia $AO^2 = EO.\ OI$.

Alua, nolaila hoi, *he ratiolikewaena ke kaula* AE, *iwaena o ka apana pili* EO, *a me ke anawaena* EI, oia no keia $AE^2 = EO.\ EI$.

Pela hoi ua loaa mai ia kakou $AI^2 = OI.\ EI$; nolaila,

$AE^2 : AI :: EO : OI$; a o keia hoi

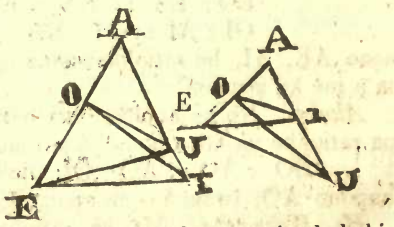
$AE^2 : EI^2 :: EO : EI$, a me keia

$AI^2 : EI^2 :: OI : EI$.

Ma ka manaohai XI, iloko o na manaopili 3 a me 4 ua hoikeia mai na ratiolike o na kuea o na aoao, ke hoopiliia kekahi me kekahi, a ke hoopiliia hoi me ke kuea o ka aoaoloa.

MANAOHAI XXIV.

Iloko o na huinakolu elua, ina ua like kekahi huina o kekahi me kekahi huina o kekahi, alaila, ua like ka ratio o ia mau huinakolu kekahi i kekahi me ka ratio o na huinahoonui o na aoao e paa ana i na huina like.



Iloko o na huinakolu AEI, AOU, i like ka huina A me ka huina A; alaila, AEI : AOU :: AE.AI : AO.AU.

E kaha ia EU. Hookahi kihi U o na huinakolu AEU, AOU, nolaila, hookahi o laua kiekie, nolaila, ua like ko laua ratio kekahi i kekahi me ka ratio o na kahamoe o laua (Manaohai VI. Manaopili); nolaila, AEU : AOU :: AE : AO. Pela hoi AEI : AEU :: AI : AU.

E hoonui iho i na kuaniti ku like o keia mau ratiolike, e waiho ana nae i ke kuaniti AEU i komo iloko o ka hikimua a me ka ukali; a ua loaa ia kakou,

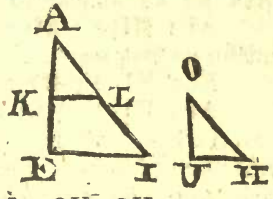
AEI : AOU :: AE×AI : AO×AU.

Manaopili. Nolaila, ua waiwailike ia mau huinakolu, ina ua like ka huinahoonui AE×AI, me AO×AU; oia no, ina ua loaa ia kakou AE: AO:: AU : AI; a ua loaa no peia, ke kaulike OI me EU.

MANAOHAI XXV.

Ua ratiolike na huinakolu anolike elua kekahi i kekahi, me ka ratio o na kuea i kauia maluna o na aoao homoloko.

I mau huinakolu anolike elua AEI, a me OUH, e like ana ka huina A, me O, a me ka huina E = U.



No ka like ana o na huina A, a me O, ma ka manaohai hope iho nei, ua loaa

AEI : OUH :: AE. AI : OU. OH.

A no ke anolike ana o na huinakolu, ua loaa,

AE : OU :: AI : OH,

E hoonui i na hua ku like o keia ratiolike me ka ratiolike maopopo,

AI : OH :: AI : OH a ua loaa mai,

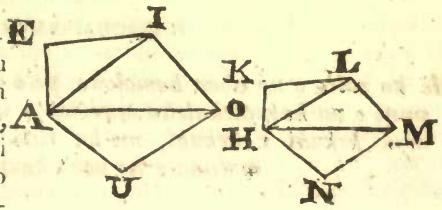
AE. AI : OU. OH :: AI^2 : OH^2.

Nolaila, ua ratiolike na huinakolu anolike elua kekahi i kekehi, me ka ratio o na kuea i kauia maluna o na aoao homoloko AI, OH, me ka ratio hoi o na kuea maluna o na aoao homoloko e ae.

MANAOHAI XXVI.

Ua like ka helu ana o na huinakolu i komo iloko o na huinalehulehu anolike elua, a ua anolike na huinakolu o kekahi me ko kekahi, a ua noho like hoi iloko o na kii.

I mau huinalehulehu anolike AEIOU, HKLMN.



Mai ka huina A iloko o ka huinalehulehu AEIOU, e kaha i na kahakapakahi AI, AO, i na huina e ae. Mai ka huina H homoloko me A e kaha i na kahakapakahi HL, HM, i na huina e ae.

No ke anolike o keia mau huinalehulehu ua like na huina homoloko AEI, HKL, a ua ratiolike hoi na aoao AE, EI, me HK, KL, oia no AE : HK : : EI : KL, (Hoakaka 1.). Nolaila, ua loaa i na huinakolu AEI, HKL, kekahi huina o kekahi i like me kekahi huina o kekahi, iwaena o na aoao ratiolike, nolaila, ua anolike ia mau huinakolu (Manaohai XX.); nolaila, ua like ka huina EIA, me KLH. E hoolawe i keia mau huina like noloko aku o na huina like EIO, KLM, a ua koe AIO = HLM.

Aka no ke anolike o na huinakolu AEI, HKL, ua loaa AI : HL : : EI : KL. A no ke anolike o na huinalehulehu ua loaa mai

EI : KL : : IO : LM; nolaila,

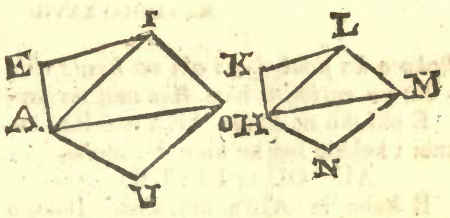
AI : HL : : IO : LM. Aka ua hoomaopopoia mai ka huina AIO = HLM; nolaila, ua loaa i na huinakolu AIO. HLM, kekahi huina o kekahi i like me kekahi huina o kekahi iwaena o na aoao ratiolike, nolaila, ua anolike ia mau huinakolu. (Manaohai XX.). Pela, ua hiki ke hoomaopopoia, ua anolike na huinakolu i koe, ke lehulehu aku na aoao o ka huinalehulehu. Nolaila, ua like ka helu ana o na huinakolu i komo iloko o na huinalehulehu anolike elua, a ua anolike na huinakolu o kekahi me ko kekahi, a ua noholike hoi iloko o na kii.

He Wehewehe. Ina ua like ka helu ana o na huinakolu i komo iloko o na huinalehulehu elua, a ina ua anolike hoi na huinakolu o kekahi me ko kekahi, a ua noho like no hoi iloko o na kii; alaila, ua anolike ia mau huinalehulehu.

No ka mea, ma ke anolike o na huinakolu ua loaa na huina AEI = HKL, EIA = KLH, AIO = HLM: nolaila, EIO= KLM; pela hoi IOU = LMN, a pela aku no. A ua loaa no hoi, AE : HK : : EI : KL : : AI : HL : : IO : LM, a pela aku no; nolaila, iloko o ia mau huinalehulehu, ua like na huina o kekahi me ko kekahi, a ua ratiolike na aoao o kekahi me ko kekahi; nolaila, ua anolike laua.

MANAOHAI XXVII.

Me ka ratio o na aoao homoloko, pela no ka ratio o na anapuni o na huinalehulehu anolike: a ua like ka ratio o na area kekahi i kekahi, me ka ratio o na kuea e kauia maluna o na aoao homoloko.



Akahi. Ma ke ano o na kii anolike, ua loaa AE : HK :: EI : KL :: IO : LM, a pela aku no: iloko o keia ratiolike mau, ua like ka ratio o ka houluulu ana o na hikimua a pau AE + EI + IO, a pela aku, i ka houluulu ana o na ukali a pau HK + KL + LM, a pela aku, me ka ratio o kekahi hikimua i kona ukali (Buke II Manaohai X): o ka houluulu ana o na hikimua a pau oia ke anapuni o ke kii mua; a o ka houluulu ana o na ukali a pau, oia no ke anapuni o ka lua; nolaila, ua like ka ratio o ke anapuni o ke kii AEIOU, i ke anapuni o ke kii anolike HKLMN, me ka ratio o AE, i kona aoao homoloko HK.

Alua. No ke anolike o na huinakolu AEI, HKL, ua loaa ka huinakolu AEI : HKL :: $EI^2 : KL^2$ (Manaohai XXV.): pela hoi iloko o na huinakolu anolike AIO, HLM, ua loaa ka huinakolu AIO : HLM :: $AI^2 : HL^2$; a no ke komo ana o ka ratio $AI^2 : HL^2$ iloko o keia mau ratiolike a elua, nolaila,

AEI : HKL :: AIO : HLM

Pela hoi e loaa mai ia kakou

AIO : HLM :: AOU : HMN;

a pela aku no, ke lehulehu aku na huinakolu, a i ka nui loa

Ma keia ratiolike mau, ua like ka ratio o ka houluulu ana o na hikimua a pau AEI + AIO + AOU, o ka huinalehulehu AEIOU no ia, i ka houluulu ana o na ukali a pau HKL + HLM + HMN, o ka huinalehulehu HKLMN no ia, me ka ratio o kekahi hikimua AEI, i kona ukali HKL, oia no me ka ratio o AE^2 ia HK^2 (Manaohai XXV.); nolaila, ua like ka ratio o na area o na huinalehulehu anolike, me ka ratio o na kuea o na aoao homoloko.

Manaopili. Ina i kauia na kii anolike ekolu maluna o na aoao ekolu o ka huinakolukupono, alaila, ua waiwailike ke kii maluna o ka aoaoloa me ka houluulu ana o na kii e ae elua: no ka mea, ua like ka ratio o keia mau kii ekolu me ka ratio o na kuea o na aoao homoloko; aka ua waiwailike ke kuea o ka aoaoloa me ka houluulu ana o na kuea o na aoao elua e ae; nolaila, ua waiwailike ke kii i kauia maluna o ka aoaoloa o ka huinakolukupono, me ka houluulu ana o na kii anolike e kauia maluna o na aoao elua e ae.

MANAOHAI XXVIII.

Iloko o ka poai, ina i oki na kaula elua kekahi i kekahi, alaila, ua ratiolike aku like mai na apana o ia mau kaula.

E oki iho na kaula AE, a me IO, kekahi i kekahi ma ke kiko U, alaila,

AU : OU : : UI : UE.

E kaha ia AI, a me OE. Iloko o na huinakolu AUI, OUE, ua like na huina ma U: a ua like hoi ka huina ma A, me ka huina ma O, no ka mea, ua kahalokoia laua iloko o ka apana hookahi o ka poai (Buke III. Manaohai XVIII Manaopili 1.); pela hoi ka huina I = E; nolaila, ua anolike na huinakolu, a ua loaa keia ratiolike ma na aoao homoloko. AU : OU : : UI : UE.

Manaopili. Nolaila, AU. UE = OU. UI; nolaila, ua waiwailike ka huinahaloa o na apana elua o kekahi kaula, me ka huinahaloa o na apana elua o kekahi kaula.

MANAOHAI XXIX.

Ina mai ke kiko hookahi mawaho aku o ka poai, e kahaia na kahaoki elua a hiki aku laua i ka pio auwaha, alaila, ua ratiolike aku like mai na kahaoki okoa, me ko laua mau apana mawaho.

E kahaia na kahaoki UE, UI, mai ke kiko U, alaila,

UE : UI : : UO : UA.

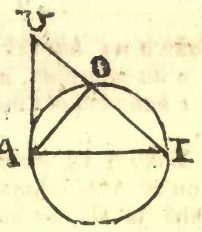
No ka mea, e kaha ia AI, EO, ua loaa i na huinakolu UEO, UAI, ka huina hookahi U; a o ka huina hoi E = I (Buke III. Manaohai XVIII. Manaopili 1.); nolaila, ua anolike keia mau huinakolu; a ua ratiolike na aoao homoloko o laua, oia no.

UE : UI : : UO : UA.

Manaopili. Nolaila, ua waiwailike ka huinahaloa UA × UE me UO × UI.

MANAOHAI XXX.

Ina, mai ke kiko hookahi mawaho aku o ka poai, e kahaia i kekahi kahapili a me kekahi kaha oki, alaila, o ke kahapili he ratiolikewaena ia mawaena o ke kahaoki okoa a me kona apana mawaho.



Mai ke kiko U, e kaha i ke kahapili UA, a me ke kahaoki UI, alaila,

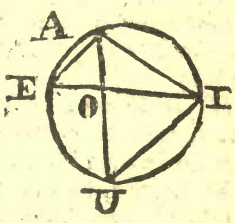
UI : UA : : UA : UO, oia no $UA^2 = UI \times UO$.

No ka mea, i ke kaha ana ia AI, AO, ua loaa i na huinakolu UAO, UAI, ka huina hookahi U; a o ka huina UAO, i hanaia e ke kahapili a me ke kaula, ua anaia oia e ka hapalua o ka pio AO, (Buke III. Manaohai XXI.); a oia no hoi ke ana o ka huina I, nolaila, UAO = I; nolaila, ua anolike ia mau huinakolu, a ua loaa keia ratiolike,

UI : UA : : UA : UO, oia no $UA^2 = UI.\ UO$.

MANAOHAI XXXI.

Ina i mahelelikeia kekahi huina o ka huinakolu e ke kaha i kahaia a hiki i ka aoao kue i ua huina la, alaila, ua waiwailike ka huinahaloa o na aoao e paa ana i ka huina i maheleia, me ke kuea o ke kaha mahele i hoululu pu ia me ka huinahaloa o na apana o ka aoao akolu.



Iloko o ka huinakolu AEI, e mahele like i ka huina A me ke kaha AO; alaila,

$AE \times AI = AO^2 + EO \times OI$.

E kaha i ka poai ma na kiko ekolu E, A, I, e hooloihi aku ia AO, a hiki i ke anapuni, e kaha hoi ia IU.

Ua anolike ka huinakolu EAO, me ka huinakolu UAI; no ka mea, ma ka olelo mua, o ka huina EAO = UAI; a o ka huina E = U no ka mea ua anaia kela a me keia e ka hapalua o ka pio AI; nolaila ua anolike ia mau huinakolu: a ma na aoao homoloko ua loaa keia ratiolike,

EA : AU : : AO : AI. nolaila,

$EA \times AI = AU \times AO$; aka AU = AO + OU e hoonui i keia mau like e AO a ua loaa.

$AU \times AO = AO^2 + AO \times OU$; aka,

$AO \times OU = EO \times OI$ (Manaohai XVIII.); nolaila,

$EA \times AI = AO^2 + EO \times OI$.

MANAOHAI XXXII.

Iloko o na huinakolu a pau, ua waiwailike ka huinahaloa o na aoao elua, me ka huinahaloa o ke anawaena o ka poai e kahawahoia me ke kaha kupono e kuuia a i ka aoao akolu.

Iloko o ka huinakolu AEI, e hookuu ia AO, e kupono ana ia EI, a e kaha ia IU, ke anawaena o ka poai kahawahoia: alaila,

$$AE \times AI = UI \times AO.$$

No ka mea, e kaha ia AU, he mau huinakolukupono AEO, AUI, ma O ka huinakupono o kekahi, a ma A ko hekahi: a o ka huina E = U; nolaila, ua anolike keia mau huinakolu, a malaila ua loaa keia ratiolike,

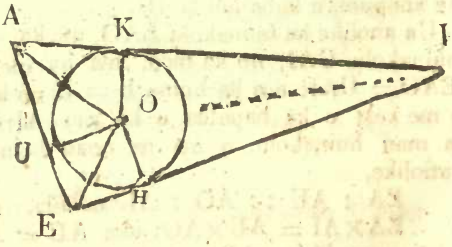
AE : UI : : AO : AI; a nolaila,

$$AE \times AI = UI \times AO.$$

Manaopili. Ina i hoonuiia keia mau kuaniti like e ke kuaniti hookahi EI, e loaa malaila,

$AE \times AI \times EI = UI \times AO \times EI$: oia hoi, ua palua AO × EI i ka area o ka huinakolu (Manaohai VI.); nolaila, *ua like ka huinahoonui o na aoao ekolu o ka huinakolu, me kona area e hoonuiia e ka palua ana o ke anawaena o ka poai i kahawahoia.*

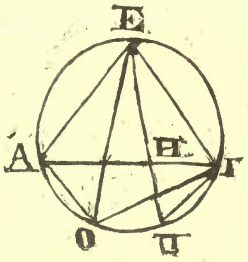
He Wehewehe. Ua hiki ke hoomaopopoia, ua like ka area o ka huinakolu me kona anapuni i hoonuiia e ka hapalua o ka hanai o ka poai i kahalokoia.



No ka mea, hookahi kihi O o na huinakolu AOE, EOI, AOI, a hookahi o lakou kiekie, o ka hanai o ka poai i kahalokoia, nolaila, ua like ka houluulu ana o ia mau huinakolu me ke houluulu ana o na kahamoe o lakou AE, EI, IA, i hoonuiia e ka hapalua o ka hanai o ka poai i kahalokoia.

MANAOHAI XXXIII.

Iloko o na huinaha a pau i kakalokoia iloko o ka poai, ua waiwailike ka huinahaloa o na kahakapakahi, me ka hoululu ana o na huinahaloa o na aoao kue.



I huinaha AEIO, i kahalokoia iloko o ka poai, e loaa ia kakou malaila,

AI×EO = AE×IO + AO × EI.

E lawe i ka pio IU, i like oia me AO, a e kaha ia EU, e halawai ana me ke kahakapakahi AI, ma H.

O ka huina AEO = IEH, no ka mea, ua anaia kekahi e ka hapalua o ka pio AO, a ua anaia kekahi e ka hapalua o ka pio UI = AO: a o ka huina AOE = EIH, no ka mea, ua kahaia laua a elua iloko o ka apana hookahi AUE; nolaila, ua anolike ka huinakolu AEO, me ka huinakolu HEI, a ua loaa ka ratiolike,

AO : HI : : EO : EI; nolaila,

AO×EI = HI×EO.

Eia hoi, ua anolike ka huinakolu AEH, me ka huinakolu EOI, no ka mea, ua like ka pio AO, me ka pio UI, a e houluulu pu me ia mau like i ka pio OU, a ua loaa ka pio AU = OI; nolaila, ua like ka huina AEH, me ka huina OEI; ua like hoi, ka huina EAH, me EOI, no ka mea, ua kahaia laua a elua iloko o ka apana hookahi; nolaila, ua anolike na huinakolu AEH, OEI, a ma na aoao homoloko ua loaa,

AE : EO : : AH : OI; nolaila, AE × OI = EO × AH

Ua loaa maluna AO × EI = HI × EO,

E houluulu pu i keia mau like ana, a loaa,

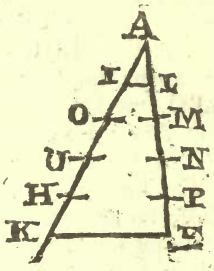
AE. OI + AO. EI = AH. EO + HI. EO,

Aka, AH. EO + HI. EO = (AH + HI) × EO = AI. EO, nolaila, AE. OI + AO. EI = AI. EO.

HE MAU NANEHAI E PILI ANA I KA BUKE AHA.

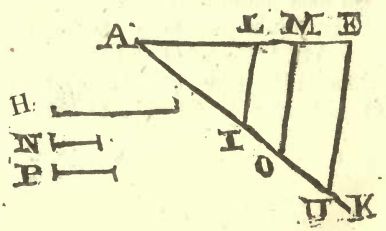
NANEHAI I.

E mahele i kekahi kaha pololei i mau apana like, i mau apana paha i ratiolike me ka ratio o kekahi mau kaha i hoikeia.



Akahi. E makemakeia paha e mahele i ke kaha AE, i elima mau apana like. Ma ka welau A, e kaha i kaha AK: a e lawe i kekahi loa AI, a e hoopili mai ia ia i elima pili ana ia AK: a e hui pu i ke kiko hope o ka pili ana K me ka welau E; alaila, e kaha ia IL, e kaulike ana me KE; alaila o AL, ka hapalima o ke kaha AE, a ina e hoopili mai ia AL, elima pili ana i ke kaha AE, ina ua maheleia mai oia elima apana like.

No ka mea, no ke kau like ana o IL, me KE, ua oki ratiolike ia mai na aoao AE, AK, ma I a me L (Manaohai XV.). Aka he hapalima AI o AK, nolaila, he hapalima AL, o AE.



Alua. E makemake paha e mahele i ke kaha AE, i mau apana ratio like me ka ratio o na kaha H, N, a me P, i hoikeia.

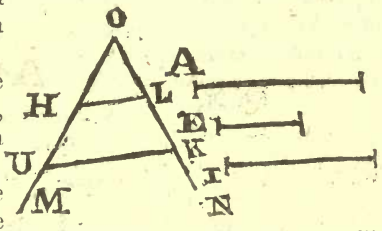
Ma ka welau A e kaha i kaha AK, e hana ia AI = H, ia IO = N, a ia OU = P, e hui pu i na welau U a me E: a ma na kiko I a me O e kaha i na kaha IL a me OM e kaulike ana me EU: ikaila, ua maheleia ke kaha AE, i mau apana AL, LM, a me ME. ratiolike me ka ratio o na kaha i hoikeia H, N, P.

No ka mea, no ke kaulike ana o na kaha IL, OM, UE, ua ratiolike na apana AL, LM, ME, me na apana AI, IO, OU; a ma ka hana ana, ua like keia mau apana me na kaha i hoikeia H, N, P.

NANEHAI II.

E imi i ka ha o na kaha ratiolike me na kaha ekolu i hoikeia A, E, I.

E kaha i na kaha elua OM, ON, e halawai ana ma kekahi huina ma O.



Maluna o OM, e lawe ia OU = A, a ia OH = E, a maluna o ON, e lawe ia OK = I.

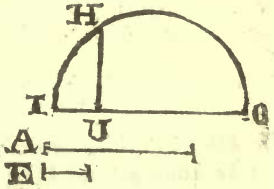
E kaha ia UK; a ma ke kiko H e kaha ia HL, e kaulike ana me UK: alaila, OL no ka ha o na kaha ratiolike i imihia: no ka mea, no ke kaulike ana o HL me UK, ua loaa OU : OH :: OK : OL; a ua like na hua mua elua o keia ratiolike me na kaha ekolu i hoikeia: nolaila, OL ka ha o na kaha ratiolike.

¦ *Manaopili.* E hiki no ke loaa ke kolu o na kaha ratiolike me na kaha hoikeia elua A, E; no ka mea, ua imiia oia ilaila, e like me keia imi ana i ka ha i na kaha ekolu A, E, E.

NANEHAI III.

E imi i ka ratiolike-waena iwaena o na kaha elua i hoikeia A *a me* E.

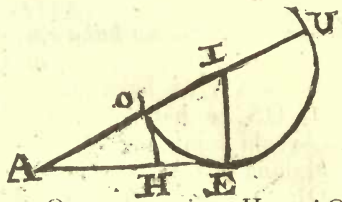
Maluna o kekahi kaha IO, e lawe ia UO = A, a ia UI = E: Maluna o ke kaha okoa IO, me he anawaena la e kau i ka hapalua poai IHO: ma ke kiko U e kukulu i ke kaha UH, e kupono ana i ke anawaena IO, a e halawai ana me ke anapuni ma H; UH no ka ratiolikewaena i imihia.



Na ka mea, o ke kupono HU, ua kuuia oia mai kekahi kiko H o ke anapuni a kupono i ke anawaena, a he ratiolikewaena ia iwaena o IU, UO, na apana elua o ke anawaena (Manaohai XXIII. Manaopili.); a ua like keia mau apana me na kaha i hoikeia A a me E.

NANEHAI IV.

E mahele i kekahi kaha e hoikeia i elua apana, i lilo ka apana nui i ratiolikewaena iwaena o ke kaha okoa a me kela avana.



AE ke kaha i hoikeia,

Ma E ka welau o ke kaha e kukulu i ke kaha kupono EI, i like oia me ka hapalua o AE; mai ke kikowaena I, me ka hanai IE, e kaha i ka hapaluapoai: e kaha ia AI, e oki ana i ke anapuni ma O; a e lawe ia AH = AO: ua maheleia ke kaha ma H e like me ka makemake i hoikeia: oia no keia, ua loaa malaila, AE : AH : : AH : HE.

No ka mea, no ke kupono ana o AE, i ka hanai ma kona welau he kahapili ia: a ina e hooloihiia AI, a hiki hou oia i ke anapuni ma U, e loaa ia kakou AU : AE : : AE : AO (Manaohai XXX.); nolaila, ma ka puunaue ana,

AU — AE : AE : : AE — AO : AO. Aka ua like ka hanai me ka hapalua o AE, nolaila, ua like ke anawaena OU, me AE, a nolaila, AU — AE = AO = AH; eia hoi no ka like ana o AH, me AO, ua loaa mai,

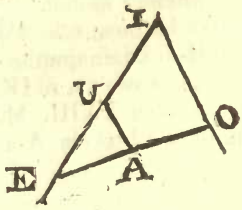
AE — AO = HE: nolaila,

AH : AE : : HE : AH; nolaila, ma ka hooloili ana i na welau a me na waena ua loaa AE : AH : : AH : HE.

He Wehewehe. O ka mahele ana e like me neia o ke kaha AE, ua kapaia oia *o ka mahele ana iloko o ko ka welau a me ko ka waena ratio.* He pono hoi ke olelo iho, ua maheleia ke kahaoki AU, iloko o ko ka welau a me ko ka waena ratio ma ke kiko O; no ka mea, no ka like ana o AE, me OU, ua loaa AU : OU : : OU : AO.

NANEHAI V.

He kiko i hoikeia maloko o kekahi huina i hoikeia: e kaha i ke kaha ma ua kiko nei, i like ka loa mai ke kiko aku a i na aoao elua o ka huina.



EIO, ka huina i hoikeia,

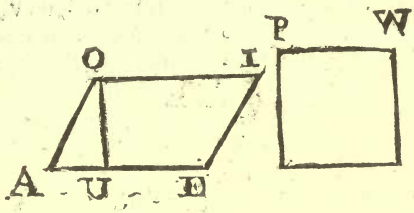
A ke kiko i hoikeia.

Ma ke kiko A e kaha ia AU, e kaulike ana me IO, a e lawe ia EU = UI; ma na kiko E a me A e kaha i ke kaha EAO, o keia no ke kaha i makemakeia.

No ka mea, ma ke kaulike ana o UA me IO, ua loaa EU : UI : : EA : AO; aka, EU = UI; nolaila, EA = AO.

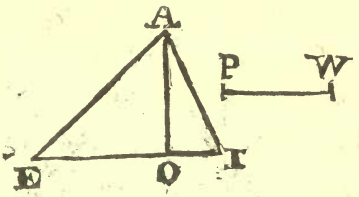
NANEHAI VI.

E kaha iho i huinahalike, i waiwailike oia me kekahi huinahakaulike i hoikeia, me kekahi huinakolu paha e hoikeia.



Akahi. AEIO, ka huinahakaulike i hoikeia, AE, kona kahamoe, OU, kona kiekie. E imi a loaa ka ratiolikewaena PW, iwaena o AE, a me OU; alaila, ua waiwailike ke kuea e kauia maluna o PW, me ka huinahakaulike AEIO.

No ka mea, ma ka hana ana AE : PW : : PW : OU; nolaila, $PW^2 = AE \times OU$; aka $AE \times OU$, ke ana o ka huinahakaulike, a o PW^2 ke ana o ke kuea; nolaila, ua waiwailike laua.



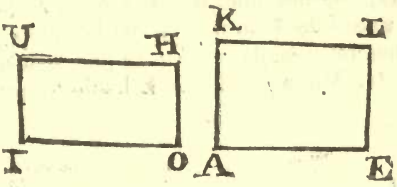
Alua. AEI, ka huinakolu i hoikeia, EI, kona kahamoe, AO, kona kiekie: e imi a loaa ka ratiolikewaena PW, iwaena o EI, a me ka hapalua o AO: o ke kuea e kauia maluna o PW, ke kuea i makemakeia, ua waiwailike oia me ka huinakolu AEI.

No ka mea, ma ka hana ana,

AI : PW : : PW : $\frac{1}{2}$ AO, nolaila, PW^2 ke ana o ke kuea $= EI \times \frac{1}{2}$ AO, ke ana o ka huinakolu.

NANEHAI VII.

Maluna o ke kaha i hoikeia e kau iho i huinahaloa, i waiwailike oia me kekahi huinahaloa i hoikeia.



AE ke kaha i hoikeia, IOHU, ka huinahaloa i hoikeia.

E imi i ka ha o na kuaniti ratiolike me na kaha ekolu AE, IO, IU; AK, ua kuaniti ratiolike

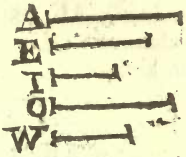
nei aha. O ka huinaha e hanaia me na kaha AE, AK, ua waiwailike ia me ka huinahaloa IOHU.

No ka mea, ma ka ratiolike AE : IO : : IU : AK, ua loaa AE×AK = IO×IU; nolaila, ua waiwailike ka huinahaloa AELK, me ka huinahaloa IOHU.

MANAOHAI VIII.

E imi i na kaha elua i like ko laua ratio, me ka ratio o na huinahaloa elua i hoopaaia e na kaha i hoikeia.

A×E, I×O na huinahaloa i hoopaaia e na kaha i hoikeia A, E, I, O.



E imi ia W ka ha o na kaha ratiolike me na kaha ekolu E, I, O; alaila, ua like ka ratio o na kaha elua A a me W me ka ratio o na huinahaloa A×E a me I×O.

No ka mea, ma ka ratiolike, E : I : : O : W, ualoaa I×O = E×W, nolaila,

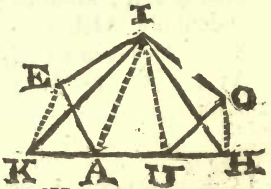
A.E : I.O : : A.E : E.W : : A : W.

Manaopili. Nolaila, ina i makemakeia ka ratio o na kuea i kauia maluna o na kaha A a me I, e imi ia W i ke kolu o na ratiolike me A a me I, i ku ka ratiolike ana penei A : I : : I : W; malaila ua loaa A. W = I^2 a me A^2. W = $A.I^2$; nolaila, A^2 : I^2 : : A : W.

NANEHAI IX.

E imi i ka huinakolu i waiwailike oia me ka huinalehulehu i hoikeia.

AEIOU, ka huinalehulehu hoikeia.



E kaha mua i ke kaha kapakahi IU, e hookaawale aku ana i ka huinakolu IOU: ma ke kiko O e kaha iho ia OH, e kaulike ana me IU, a hahawai pu me AU, i hooloihiia; e kaha ia IH, ua waiwailike ka huinalehulehu AEIOU, me ka huinalehulehu AEIH, ka i emi iho ke-kahi aoao i ko ka huinalehulehu mua.

No ka mea, hookahi kahamoe IU, o na kuinakolu IUO, IUH, ua like hoi ko laua kiekie, no ka mea, ke ku nei ko laua mau kihi O a me H ma ke kaha OH, i kaulike me ke kahamoe, nolaila, ua waiwailike keia mau huinakolu (Manohai II. Manaopili 2.). E houluulu pu me ia mau huinakolu i

ke kii AEIU, a ua loaa ka huinalehulehu AEIOU, waiwailike me ka huinalehulehu AEIH.

Pela no hoi ua hiki ke oki kaawale aku i ka huina E, e lawe ana i ka huinakolu AEI, a e pani ana i kona hakahaka me ka huinakolu waiwailike AIK, a pela ua hoomaluleia ka huinalima AEIOU, i huinakolu waiwailike KIH.

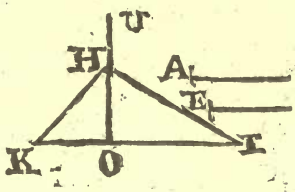
Ua hiki ke hoopili i ka hana e like me neia i na kii a pau; no ka mea, ma ka hooemi ana i kekahi aoao, a e hooemi hou ana, e loaa uanei ka huinakolu waiwailike.

He Wehewehe. Ua ike kakou mamua aku nei, he mea hiki ke hoomalule i ka huinakolu i huinahalike waiwailike (Nanehai VI.): a pela no, ua hiki mau ke loaa i ke kuca waiwailike me kekahi kii kaha pololei; a ua kapaia keia hana, o ke *kuea ana* o ke kii kaha pololei.

NANEHAI X.

E imi i ke kuea i waiwailike me ka houluulu ana paha, me ka like ole paha o na kuea elua i hoikeia.

A a me E na aoao o na kuea i hoikeia.



Akahi. Ua imihia ke kuea i waiwailike oia me ka houluulu ana o keia mau kuea.

E kaha i na kaha pololei elua OI, OU, e kupono ana kekahi i kekahi; a e lawe ia OI = A a me OH = E; e kaha ia HI: o HI, no ka aoao o ke kuca i imiia.

No ka mea, he huinakolukupono ka huinakolu IOH, nolaila, ua waiwailike ke kuea i kauia maluna o HI, me ka houluulu ana o na kuea i kauia maluna o na aoao OI, a me OH.

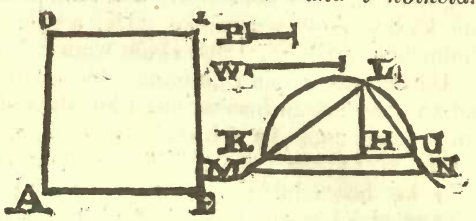
Alua. Ua imihia ke kuea i waiwailike me ka like ole o keia mau kuea.

E hana e like me mamua i ka huinakupono UOK, e lawe ia OH = ka aoao pokole o A a me E, a mai ke kiko H me he kikowaena la me ka hanai like me ka aoaoloa o laua e kaha i ka pio e oki ana i ke kaha OK, ma ke kiko K: o ke kuea e kauia maluna o OK, ua waiwailike oia me ka like ole o na kuea i kauia maluna o A a me E.

No ka mea, he huinakolukupono ka huinakolu OHK, a o ka aoaoloa HK = A, a o ka aoao OH = E; nolaila, ua waiwailike ke kuea e kauia malana o OK. me ka like ole o na kuea o A a me E.

NANEHAI XI.

E imi i ke kuea i like kona ratio i kekahi kuea i hoikeia, me ka ratio o kekahi kaha i hoikeia i kekahi kaha i hoikeia.



AI, ke kuea i hoikeia, a me P a me W na kaha i hoikeia.

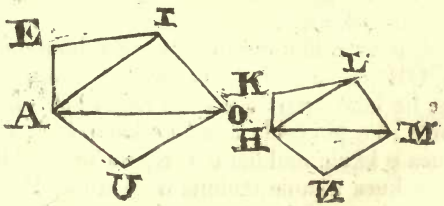
E kaha i ke kaha UK, a e lawe ia UH = P a me HK = W; maluna iho o KU, me he kahawaena lo e kau i ka hapalua poai: ma ke kiko H e kukulu ae i kupono HL: Mai ke kiko L e kaha aku i na kaula LU, LK, a e hooloihi aku ia laua. Maluna o LK, e lawe ia LM = AE, kekahi aoao o ke kuea i hoikeia, ma ke kiko M e kaha ia MN, e kaulike ana me KU; LN, ka aoao o ke kuea i imihia.

No ka mea, ma ke kaulike ana o KU, me MN, ua loaa LN : LM : : LU : LK; nolaila $LN^2 : LM^2 : : LU^2 : LK^2$, aka iloko o ka huinakolukupono KLU, ua like ka ratio o ke kuea LU, i ke kuea o LK, me ka ratio o ka apana HU, i ka apana HK, (Manaohai XI. Manaopili 3.), oia no me ka ratio o P ia W: nolaila,

$LN^2 : LM^2 : : P : W$; a LM = AE, nolaila ua like ka ratio o ke kuea i kauia maluna o LN, i ke kuea AI, me ka ratio o P ia W.

NANEHAI XII.

Maluna o kekahi kaha i hoikeia, e kau iho i huinalehulehu anolike me kekahi huinalehulehu i hoikeia.



HK, ke kaha i hoikeia, a AEIOU, ka huinalehulehu i hoikeia.

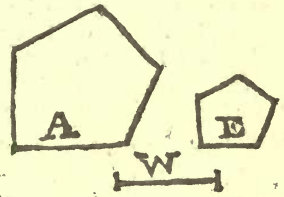
Iloko o ka huinalehulehu i hoikeia e kaha iho i na kaha kapakahi AI, AO; ma ke kiko H e hana i ka huina KHL = EAI, a ma ke kiko K a hana i ka huina HKL = AEI; e oki ana na kaha HL, KL, kekahi i kekahi ma ke kiko L, a ua anolike ka huinakolu HKL, me ka huinakolu AEI.

Pela hoi, maluna o ke kaha HL homoloko me AI, e kau iho i ka huinakolu HLM, anolike me ka huinakolu AIO; a maluna o HM, homoloko me AO, e kau iho i ka huinakolu HMN, anolike me AOU. Ua anolike ka huinalehulehu HKLMN, me ka huinalehulehu AEIOU, e like me ka mea i makemakeia.

No ka mea, ua like ka helu ana o na huinakolu i komo iloko o keia mau huinalehulehu, a ua anolike hoi na huinakolu o kekahi me ko kekahi, a ua noho like hoi iloko o na kii (Manaohai XXVI. Wehewehe.).

NANEHAI XIII.

Ua hoikeia na kii anolike elua, a ua makemakeia e kau iho i kii anolike me laua i waiwailike oia me ko laua houluulu ana, me ko laua like ole paha.



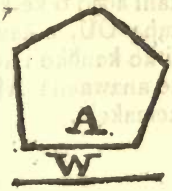
A a me E na aoao homoloko elua o na kii i hoikeia.

E imi i kuea waiwailike me ka houluulu ana paha, me ka like ole paha o na kuea e kauia maluna o A a me E; o W kekahi aoao o ua kuea la: alaila, iloko o ke kii i makemakeia, o W ka aoao homoloko me na aoao A a me E iloko o na kii i hoikeia; alaila, ua hiki ke kau iho i ke kii maluna ae o W e like me ka nanehai XII.

No ka mea, ua like ka ratio o na kii anolike me ka ratio o na kuea o na aoao homoloko o lakou (Manaohai XXVII.); eia hoi, ua waiwailike ke kuea o ka aoao W me ka houluulu ana, me ka like ole paha o na kuea o na aoao A a me E; nolaila, ua waiwailike ke kii i kauia maluna o W me ka houluulu ana, me ka like ole paha o na kii anolike e kauia maluna o A a me E.

NANEHAI XIV.

E kau iho i kii anolike me kekahi kii i hoikeia, i like hoi kona ratio ia ia me ka ratio o M *ia* N *i hoikeia.*

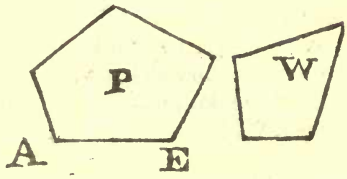


A kekahi aoao o ke kii i hoikeia, a o W ka aoao homoloko o ke kii i imihia.

He pono ke like ka ratio o ke kuea o W i ke kuea o A, me ka ratio o M ia N: nolaila, e loaa koke mai no o W ma ka nanehai XI, a akaka o W, e pau koke ke koena i ka hanaia ma ka nanehai XII.

NANEHAI XV.

E hana i kii anolike me ke kii P, *a waiwailike hoi me ke kii* W.



E imi ia M, kekahi aoao o ke kuea waiwailike me ke kii P, a ia N hoi kekahi aoao o ke kuea waiwailike me ke kii W. E imi hoi ia L ka ha o na kaha ratiolike me M, N, AE; maluna o L ka aoao homoloko me AE, e kau iho i kii anolike me P; ua waiwailike no hoi ia me ke kii W.

No ka mea, e kapa aku i ke kii i kauia muluna o L, o H, a ua loaa,

P : H : : AE^2 : L^2; aka, ma ka hana ana,

AE : L : : M : N oia no hoi,

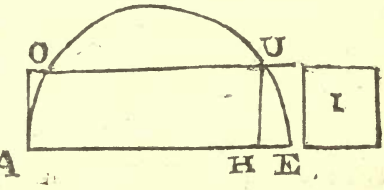
AE^2 : L^2 : : M^2 : N^2; nolaila,

P : H : : M^2 : N^2. Aka, ma ka hana ana, M^2 = P a o N^2 = W; nolaila,

P : H : : P : W; nolaila, H = W; nolaila, o ke kii H, ua anolike oia me ke kii P, a ua waiwailike oia me ke kii W.

NENAHAI XVI.

E hana i huinahaloa i waiwailike oia me kekahi kuea i hoikeia, i like hoi ka houluulu ana o na aoao pili ona me kekahi kaha i hoikeia.



O ke kuea hoikeia, o I no ia; AE ke kaha i like me ka houluulu ana o na aoao o ka huinahaloa i makemakeia.

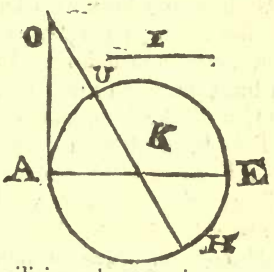
Maluna o AE, me he anawaena la, e kau iho i hapaluapoai: e kukulu ia AO, e kupono ana ia AE, i like kona loa me kekahi aoao o ke kuea I i hoikeia; ma ke kiko O e kaha i ke kaha OU, e kaulike ana me AE; mai ke kiko U kahi i oki ai ke kaulike i ke anapuni e kuu iho ia UH, e kupono ana i ke anawaena AE. AH, HE, na aoao o ka huinahaloa i makemakeia.

No ka mea, ua like ko laua houluulu ana me AE; a ua waiwailike ka huinahaloa AH×HE me ke kuea o HU, oia no me ke kuea o AO, (Manaohai XXIII. Manaopili.); nolaila, ua waiwailike ia huinahaloa me ke kuea I i hoikeia.

He Wehewehe. I hiki keia nanehai ke hanaia, aole pono ke oi aku ka loa o AO, i ka hanai; oia no keia, aole pono ke nui aku ka aoao o ke kuea I i hoikeia i ka hapalua o ke kaha AE, i hoikeia.

NANEHAI XVII.

E hana i huinahaloa i waiwai like oia me kekahi kuea i hoikeia, i like hoi ka like ole ana o na aoao pili ona me kekahi kaha i hoikeia.



Ua like ke kaha I me kekahi aoao o ke kuea i hoikeia, a ua like AE me ka like ole o na aoao pili o ka huinahaloa i makemakeia.

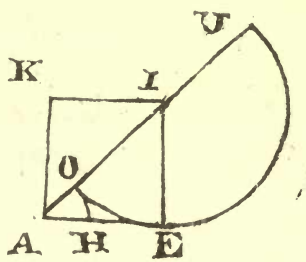
Maluna o AE, me he anawaena la, e kau iho i poai: ma kona welau e kaha i ke kahapili AO = I: mai ke kiko O e kaha i ke kahaoki OH, e holo ana ma ke kikowaena K; alaila, OU a me OH, na aoao pili i makemakeia.

No ka mea, akahi, o ka like ole o keia mau aoao, ua like ia me UH, ke anawaena, oia no AE; alua, ua waiwailike ka huinahaloa OH×OU, me AO^2 (Manaohai XXX.); nolaila, ua waiwailike keia huinahaloa me ke kuea o I.

NANEHAI XVIII.

Ina he mea hiki, e imi i ke ana-akahi e ana pono ai i ke kaha kapakahi o ke kuea a me kona aoao.

I kuea AEIK, AI, kona kaha kapakahi.



Ua pono ia kakou ke hoopili mua ia IE, maluna o IA. Ilaila, e kaha iho i ka hapaluapoai OEU, mai ke kikowaena I me ka hanai IE. Ua maopopo ua komo IE, hookahi komo ana iloko IA, a koe aku OA, a o ka hai loaa o ka hana mua ana

oia no ka puuhapa 1, me ke koena AO, a he pono ke hoopili ia AO, me IE, a i ole ia, me kona like AE.

Maanei ua hiki ia kakou ke lawe ia AH = AO, a e hoopili iho no ia ia maluna o AE; a e loaa ia kakou ilaila ka puuhapa 2 a me kekahi koena: aka, no ka uuku ana o ia koena, a me ke emi iho ana o na koena ma ia hope aku, aole hiki ma ka hana lima ke hoomaopopo pono, ina he ana-akahi, a ina aole, e hiki ai ke ana pono i na kaha AI, IE. Aka, eia mai kekahi hana oluolu e hoomaopopo ana i keia mea.

He huinakupono ka huina AEI, he kahapili AE, a he kahaoki AU, i kahaia mai ke kiko hookahi A; a ua loaa ilaila,

AO : AE : : AE : AU, (Manaohai XXX.).

Nolaila, i ka lua o ka hana ana, i ka hoopili ana ia AO, me AE, he pono ke lawe i ka ratio o AE, ia AU, no ka mea, ua like ia me ka ratio o AO, ia AE; a o AE = OI, elua ona komo ana iloko o AU, a keu aku AO, a o ka hailoaa o ka lua o ka hana ana, oia no ka puuhapa 2 a me ke koena AO; a oia ke hoopiliia me AE.

Pela hoi o ke kolu o ka hana ana, o ka hoopili ana ia AO, me AE, ua hiki ke hoohalikeia oia me ka hoopili ana ia AE = OI, me AU; malaila ua loaa hou ka puuhapa 2 a me ke koena AO.

Malaila ua akaka he hana hope ole keia, a nolaila, aole loa he ana akahi e ana pono i ke kaha kapakahi a me ka aoao o ke kuea: he oiaio keia i ikea ma ka helu, no ka mea, ua like ka ratio o keia mau kaha kekahi i kekahi me : : $\sqrt{2}$: 1 (Manaohai XI. Manapili 4.): aka, nui aku ka maopopo ma keia wehewehe anahonua ana.

KE

ANAHONUA.

OIA KA MEA E IKE AI

Ke kumu o

KE ANA AINA A ME KA HOLO MOKU

HE MEA IA E PONO AI KE KULANUI.

LAHAINALUNA.

.....

1834.

KE ANAHONUA,

Ka mea e maa'i ke ana ma ka hana.

HE WAHI HOAKAKA.

O ke ANAHONUA ka mea e ike ai i ke ano o na mea i hoo-palahalahaia, oia na *kaha*, a me na *ili*, a me na *paa*. Hoike mai no ke anahonua i ke ano o ia mau mea pakahi, a me ko lakou ano, ke huiia.

1. O ke KIKO. Oia ka mea palahalaha ole. Aole ona loa, aole ona laula.

2. O ke KAHA; he loa wale no ko ke kaha; aole laula, aole manoanoa. Ua hanaia ke kaha ma ka hoonee ana i ke kiko; me he penikala la.

3. O ke KAHA POLOLEI; oia ke kaha e moe pololei ana ma-waena o na kiko elua, oia kona mau poo, me ka hooluli ole i kona hele ana, me

A——————E.

4. O ke KAHA KEKEE; oia ka hooluli mau i kona hele ana me A. E.

Ma ka olelo ana, ua hoikeia mai ke kaha ma na hua elua ma kona mau poo. Penei, o ke kaha E A.

5. O na *kahakaulike*; oia na kaha e moe like ana, aole e hui pu aole e kaawale ae, hele like a mau aku no, me A E I O.

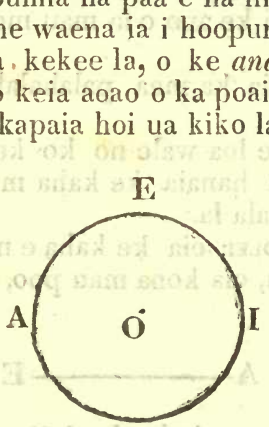
6. O ka *ili*; he loa ko ka ili a me ka laula, aole nae mānoanoa; ma ka manao ana, he mea palahalaha ia, a ua hoopuniia hoi e na kaha.

7. O ka *ililaumania*; oia ka ili e moe palahalaha ana kona kukulu, aole kekee, pili no ke kaha pololei ma na wahi a pau mai kekahi aoao a i kahi aoao.

8. O ka *ilihualala*; hamo mau no kona kukulu, me he poepoe la.

9. O ka mea *paa;* he *loa* no ko ka paa, a he *laula*, a he *manoanoa* hoi, ua hoopuniia na paa e na ili.

10. O ka *poai*; he waena ia i hoopuniia e ke kaha kekee, a ua kapaia ua kaha kekee la, o ke *anapuni*, me A E I; a ua like no kela aoao keia aoao o ka poai mai ke kiko mawaena mai, me O, ua kapaia hoi ua kiko la, he *kikowaena* a he *waenakonu*.

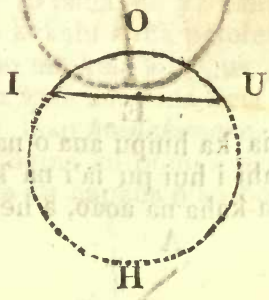


Ma ka manaoia, ua mahelehele na anapuni a pau i 360 hapa like, ua kapaia hoi ua poe hapa la, na *degere;* ua mahelehele hou na degere i 60 hapa like i kapaia na *minute*; ua mahele hou ia no na minute i 60 hapa like i kapaia na sekona.

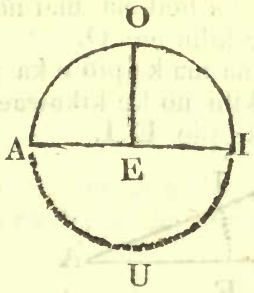
Peneia ka palapala ana i na Degere, a me na Minute, a a me na Sekona 40^{0} 32^{1} 15^{11} eia ke ano, 40 degere, 32 minute a me 15 sekona.

11. O ka *pio*; oia ka hapa o ke anapuni o ka poai; me I O U.

12. O ke *kaula* o ka pio; oia ke kaha pololei e hoopa ana i kela poo i keia poo o ka pio, me I U. Oia ka i mahelelua i ka poai i elua apana like ole, ua kapaia hoi ua mau apana la, he mau *apanapoai*, me I O U, a me I H U.



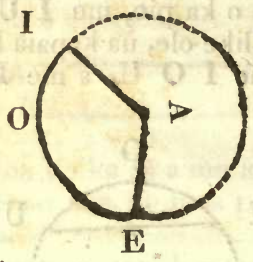
13. O ke *anawaena;* oia ke kaha pololei e moe ana ma kekahi aoao o ka poai a hiki i kekahi aoao, a ma ke kikowaena hoi, me A E I; ua mahelelia ka poai e ke anawaena i elua hapalike, ua kapaia hoi, he *poaihapalua*, me A O I a me A U I.



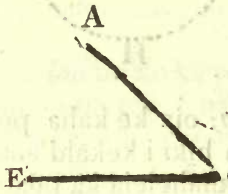
14. O ka *poaihapaha*; oia ka hapalua o ka poaihapalua, oia hoi ka hapaha o ka poai, me A E O, a me O E I.

15. O ka *hanai;* oia ke kaha pololei e moe ana ma ke kikowaena a hiki i ke *anapuni*, oia ka wa i weheia ae ka upa i ke kaha ana i ka poai; me A E a me E I.

16. O ka *apana V;* oia ka wa mawaena o na hanai elua a me ka pio; me E A I O.

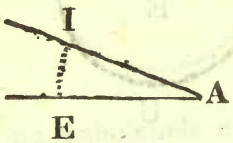


17. O ka *huina*; oia ka huipu ana o na kaha elua ma ke kiko hookahi. O kahi i hui pu ia'i na kaha, ua kapaia, he kihi; ua kapaia hoi na kaha na aoao, a he wawae paha.



18. Ua hoikeia mai ka huina ma na hua ekolu ma kona kihi a me kona mau wawae; o ka hua mawaena, oia ka hua ma ke kihi; me A O E: ua hoikeia mai no hoi ma ka nui ma ka hua hookahi ma ke kihi; me O.

19. Ua anaia ka huina ma ka pio o ka poai mawaena o kona mau wawae, o ke kihi no ke kikowaena; penei, ua anaia ka huina E A I, e ka pio E I.



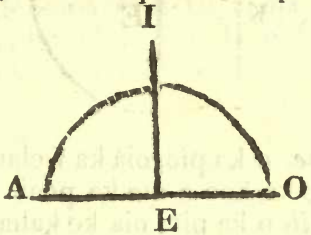
20. Ua oleloia ua like kekahi huina me kekahi, ke like na pio ka mea i anaia'i lakou.

21. Ua manaoia ua like kekahi huina me kekahi, a ua nui ae paha, a ua uuku iho paha e like me ka nui a me ka uuku o na pio o ua mau huina la.

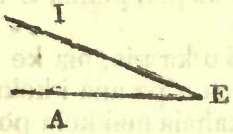
Nolaila, i ke ana ana i ka huina, aole pono ke manao ma ka loihi o na wawae, ma ke kaawale ana no o na wawae elua o ka huina.

22. Ma ka manaoia, ua maheleia na poai a pau i 360 hapa like, i kapaia na degere; a ua heluia kekahi mau degere mawaena o na wawae elua, nolaila, ua oleloia no kekahi huina, he huina ia o na degere he 15 paha, he 27 paha, he 62 paha.

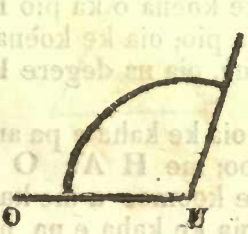
23. I ka pili ana o kekahi kaha pololei me kekahi, a like ka huina ma kela aoao ma keia aoao, ua kapaia he *kahakupono*; a o na huina ma kela aoao ma keia aoao o ua kaha ku pono la, ua kapaia he mau *huinakupono;* me A E I, a me O E I: nolaila, o na huina ku pono a pau, he mau huina ia o na degere he 90, oia ka hapaha o ka poai.



24. O ka *huinaoi*, oia ka huina hina iloko o ka huinakupono; ua emi mai oia i na degere he 90; me A E I.

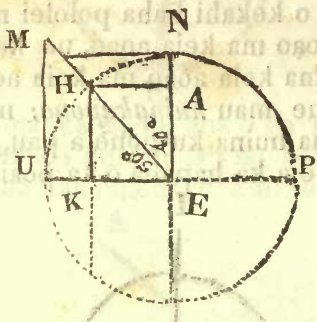


25. O ka *huinapeleleu;* oia ka huina hina iwaho o ka huinakupono, a nui ae ia i na degere he 90; me O U H.



26. Ua kapaia na huinaoi a me na huina peleleu he mau *huinahio.*

27. O ke *koo* o ka pio; oia ke kaha pololei e pa ana ma kekahi poo o ka pio a ku pono no hoi ma ke anawaena e pa ana i kela poo, ua like no ia me ka hapalua o ke kaula ke palua ka loihi o ke pio. Penei, o H K ke koo o ka pio H U.



28. O ke *koomoe* o ka pio; oia ka welau o ke anawaena e moe ana mawaena o ke koo a me ka poai. Penei, K U.

29. O ke *kahapili* o ka pio; oia ke kaha pololei e kupono ana ma ke poo o ke anawaena ma kahi ia e pili ai kekahi poo o ka pio a hiki i kahi e hui ai me ke kaha e mai ke kikowaena nana i oki i kela poo o ka pio; penei; U M, oia ke kahapili o ka pio H U.

30. O ke *kahaoki* o ka pio; oia ke kaha pololei i kahaia ae la mai ke kikowaena e pa ana i kekahi poo o ka pio a hui oia me ke kahapili i kahaia mai kela poo mai o ka pio; penei, E M, oia ke kahaoki o ka pio H U.

31. O ke *koena* o ka pio; oia kela hapa o ka pio i koe a lilo kekahi huina i huina kupono; oia ka huina o na degere he 90; me H N, oia ke koena o ka pio H U.

32. O ka *piha* o ka pio; oia ke koena o ka pio aole lilo ia i mau huinakupono elua, oia na degere 180. me H P, oia ka piha o ka pio H U.

33. O ke *koo okoa*; oia ke kaha e pa ana i ke kaha oki a ku pono no hoi me ke koo; me H A. O ke *koomoe okoa;* oia ke kaha mawaena o ke koomoe a me ka poai; me A N. O ke *kahapili okoa;* oia ke kaha e pa ana i ka poai me ke-

kahi poo, a pa kekahi poo i ke kahaoki, me N M. O ke kahaoki okoa, hookahi no ia me ke kahaoki; me E M.

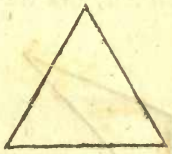
34. O ke *koo okoa*, a me ke *kahapili okoa*, a me ke *kahaoki okoa*, a me ke *koo moe okoa* o ka pio, oia no ke koo, a me ke kahapili, a me ke kahaoki, a me ke koo moe o ke koena o ka pio: pene; H A, oia ke koo okoa, M N, oia ke kahapili okoa, E M, oia ke kahaoki okoa, A N, oia ke koo moe okoa o ka pio H U.

O ke koo, o ke kahapili, o ke kahaoki o ka pio, oia hoi ke koo, a me ke kahapili, a me ke kahaoki o ka piha o ua pio la.

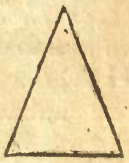
35. Ua anaia ka huina e ka pio o ka poai; nolaila, o ke koo, a me ke kahapili, a me ke kahaoki o kekahi pio, oia no ke koo a me ke kahapili a me ke kahaoki o ka huina i anaia e kela pio. Ina paha he 50 degere ma ka pio *H* U, oia ka pio e ana ana i ka huina *H* E U; alaila, o ke kaha H K, oia ke koo o ka huina he 50 degere H E U; a o ke kaha M U, oia ke kahapili o kela huina he 50 degere; a o ke kaha M E, oia ke kahaoki o kela huina he 50 degere; a o ke kaha U K, oia ke koomoe o kela huina he 50 degere. A o kela mau kaha, o lakou no ke koo okoa a me ke kahapili okoa a me ke kahaoki okoa a me ke koomoe okoa o ka huina M E N; he 40 degere no ia huina; a he koena hoi ia no kela huina he 50 degere.

36. O ka *huinakolu*; oia ka mea i hoopuniia e na kaha pololei ekolu, ekolu no ona huina. Nui ke ano o na huina kolu, aia e like me ke ano o na huina a me ke ano o na aoao.

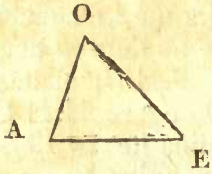
37. O ka *huinakolu like*; oia ka huinakolu i like na aoao a pau kekahi i kekahi, meneia.



38. O ka *huinakolu eluaaoaolike;* oia ka mea i like na aoao elua, aole like ke kolu me ia mau aoao elua, meneia:



39. O ka *huinakolu aoaolikeole;* oia ka huinakolu like ole na aoao a pau; meneia:



40. O ka *huinakolu kupono;* oia ka huinakolu kupono kekahi huina ona; he 90 degere o ua huina la, me H; o ka aoao ku e aku i ka huinakupono, ua kapaia oia ka *aoaoloa*, me H E a o kela mau aoao elua, ua kapaia laua, he mau *wawae*, a he kupono kekahi, he moe kekahi, meneia:

41. O ka *huinakoluoi;* oia ka huinakolu i oi kona mau huina a pau me ka huinakolu A E O.

42. O ka *huinakolu peleleu;* oia ka huinakolu i peleleu kekahi huina ona, meneia:

43. O na *huinakoluhio;* o na huinakolu a pau loa ma aole kupono, ua kapaia na *huinakoluhio.*

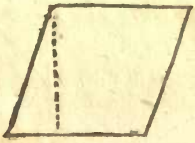
44. Ina i hui pu na degere o ka huinakolu 180 degere no ia, a o ka huina kupono he 90 no ia, nolaila, o na huina oi elua o ka huina kupono, he 90 no degere ke huiia laua elua, a i huipuia lakou ekolu, 180 no degere.

45. O ke *kiekie* o ka huinakolu; oia ke kaha i kauia mai kekahi huina a i ka aoao e ku e mai ana, meneia:

46. O ka *huinahalike;* oia ka mea aoao like eha, a me na huinakolu kupono eha, meneia;

47. O ka *huinahaloa;* oia ka mea huinaha, a ua loihi kekahi mau aoao a pokole kekahi mau aoao, meneia;

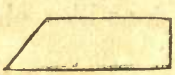
48. O ka *huinahahio;* oia ka mea i like na aoao a pau ma ka loa, aole i like na huina, he oi kekahi, he peleleu kekahi, meneia:



49. O ka *huinahahio loihi;* oia ka mea aoao eha, elua aoao like a loihi no, elua aoao like hoi a pokole nae, aole like na huina, he oi kekahi, he peleleu kekahi, meneia:

50. O ke kiekie o ka *huinahahio* a me ka *huinahahio loihi;* oia ke kaha i kauia mai kekahi huina a i ka aoao e ku e ana.

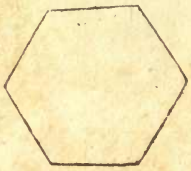
51. O ka *huinaha lualike;* oia ka mea i kau like ia na aoao elua, a ua kau like ole hoi na aoao elua, meneia:



52. O ka *huinaha like ole;* oia ka mea like ole na aoao a me na huina, meneia;

53. O ke *kaha kapakahi;* oia ke kaha e moe ana mai kekahi huina a i kekahi huina e.

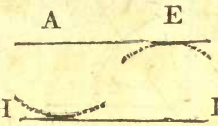
54. O na mea aoao nui mamua o na mea eha, o ka huinalima paha, o ka huinaono paha, o ka huinahiku paha a pela aku no, ua kapaia lakou, he *huina lehulehu* Ina like na aoao, ua kapaia he huina *lehulehu like.* Ina like ole na aoao, ua kapaia, he *huina lehulehu like ole.* meneia:



NANEHAI NO KE ANAHONUA.

NANEHAI 1.

E kau i ke kaha kau like me kekahi kaha e, oia ka wa mawaena o laua e like me ka olelo ana; menei, ma ke kiko A, e kau i ke kaha kaulike me H K.

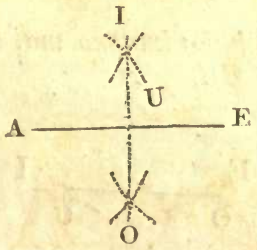


E wehe ae i ka upa e like me ka wa mawaena o ke kiko A a me kauwahi kokoke loa ma ke kaha H K i hoikeia; alaila, me kela ano o ka upa e kau iho i kekahi wawae ma kahi e o ke kaha H K a e kaha i ka pio E. Alaila me ka rula e kaha ai i ke kaha mai ke kiko A, a pili i ka pio E, a ua kau like no ke kaha A E, me ke kaha H K.

A o ka rula kaulike ka mea e hiki wawe ai.

NANEHAI 2.

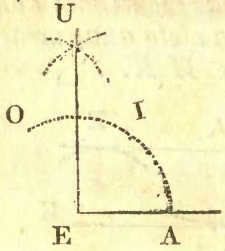
E mahelelua i ke kaha i hoikeia; oia ka loaa i kona waena konu.



E wehe ae i ka upa a oi aku i ka hapalua o ke kaha A E; e kau hoi i kekahi wawae o ka upa ma A,a e kaha i na pio maluna a malalo o ua kaha la me I a me O; a me kela wehe ana no o ka upa e kau hou i kekahi wawae ma E, a e kaha i mau pio hou a oki ae kekahi i kekahi; alaila e kau i ka rula ma kahi i oki ai na pio me I a me O, a ma kahi i oki ai ka rula i ke kaha A E, oia ka waenakonu o ua kaha la me U.

NANEHAI 3.

E kukulu ae i kaha kupono mawaena paha ma ke poo paha o ke kaha i oleloia, me E A.

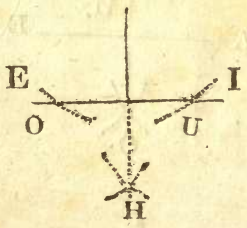


E wehe ae i ka upa a kau ma E a ma A paha, hookahi wawae ma ke kiko E e kaha i ka pio A I O; me kela wehe ana no o ka upa e ae like ai mai A a i I a mai I a i O; e kau i kekahi wawae o ka upa ma I a e kaha i pio uuku, alaila e kau hou i kekahi wawae o ka upa ma O a e kaha i pio uuku a oki ae la ia i kela pio uuku ma U, a ma kahi i oki ai ia mau pio uuku e kaha mai i kaha pololei a hiki i E, oia ke kaha kupono.

He ano e ae no e pili i keia hana ana, oia maluna paha ka pokole.

NANEHAI 4.

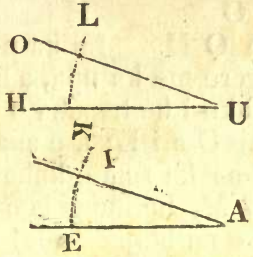
E hookuu i lalo i kaha kupono mai kekahi kiko ma A a i ke kaha i oleloia me E I. A



Ma *A* kekahi wawae o ka upa, alaila e kaha i mau pio e oki ana i ua kaha la ma O a me U; e kau hou i ka upa ma O a me U, a e kaha i mau pio hou malalo ae o ua kaha la e oki ana kekahi i kekahi ma H; e kau i ka rula mai *A* a H, a e kaha ae la mai *A* a i ke kaha i oleloia, a ua hookuu mai la ke kaha kupono mai ke kiko mai o *A*.

NANEHAI 5.

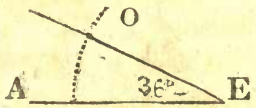
E kaha i ka huina ma A, i like loa ia me ka huina e ae i oleloia, me O U H.



E wehe ae i ka upa, a hookahi wawae ma U e kaha i ka pio K L; me kela wehe ana no o ka upa e kau i kekahi wawae ma A, e kaha i ka pio E; e ana i ka pio K L a e hoopili i kela ana ana ma ka pio E a hiki i I, e kau ae i ke kaha mai A a oki i ka pio ma I, a ua like no ia mau huina.

NANEHAI 6.

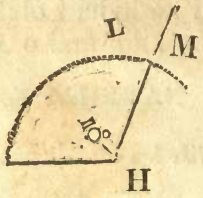
E kaha i huina oi i like me na degere i oleloia, 36 *paha degere.*



E kaha i ke kaha A E; mai ka poe kiko kaula ma ka rula e lawe i 60 degere me ka upa, a hookahi wawae ma E e kaha i ka pio mai ke kaha A E aku; a mai kela poe kiko kaula no e lawe i na degere i oleloia, a e hoopili aku i ka pio mai I a O; e kaha ae i kaha mai E a oki i ka pio ma O; a o ka huina ma E, he huina no ia o na degere 36.

NANEHAI 7.

Ekaha i huina pelelеu 110 paha degere.

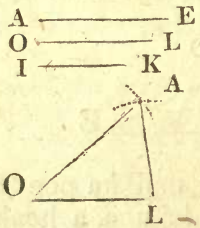


E kaha i ke kaha O H. Mai ka poe kiko kaula ma ka rula e lawe i 60 degere me ka upa, a hookahi wawae ma H, e kaha i ka pio i oi aku i ka hapaha o ka poai; alaila e ana i na degere he 90 mai O a i L; a e ana i na degere i koe he 20 mai L a i M; me ka rula e kaha i ke kaha mai H a i M: o ka huina O H M, he huina ia o na degere 110.

Penei ke ana ana o na huina. Mai ka poe kiko kaula ma ka rula e lawe i 60 degere me ka upa, a hookahi wawae ma ke kihi o ka huina, e kaha i ka pio mai kela wawae a i keia wawae o ka huina; alaila, me ka upa e ana i ka pio ma ka poe kiko kaula i kakauia ma ka rula.

NANEHAI 8.

E kaha i ka huinakolu i like na aoao me na kaha ekolu i hoikeia mai.

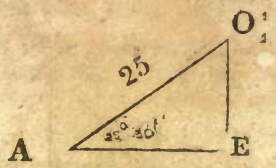


E kau i ke kaha O L, mai O a i L. E wehe ae i ka upa e like me ke kaha A E, a ma O kekahi wawae o ka upa e kaha i ka pio ma A. E wehe hou i ka upa e like me ke kaha I K, a ma L kekahi wawae o ka upa, e kaha i ka pio e oki i kela pio ma A. Mai A e kaha i ke kaha A O, a me ke kaha A L. A ua likeia na aoao o ka huinakolu A O L me kela mau kaha ekolu.

NANEHAI 9.

E kaha i ka huinakolu kupono, ua hoikeia mai na huina a me ka aoaoloa ona.

Eia ka aoaoloa i hoikeia mai A O, 25 kaul hao, a me ka huina ma A 35 deg. 30 min. nolaila, o ka huina ma O, 54 deg. 30 min. no ia. (E nana i ka aoao 11, pauku 44.)



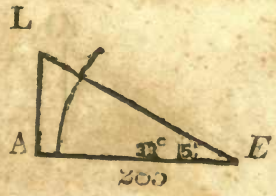
Penei ka hana ana: E kaha i ke kaha A E; a ma A e kaha i ka huina 35 deg. 30 min. (E nana i ka NANEHAI 6.) Ma na kahakaulike ma ka rula, e lawe me ka upa i na kaulahao he 25, a e ana mai A a i O a lawa he 25 kaulahao. Mai O e hookuu i ke kahakupono a i E; a ua kahaia ka huinakolu.

E hiki no ke ana i kela mau aoao elua me ka upa ma na kahakaulike ma ka rula.

NANEHAI 10.

E kaha i ka huinakolu kupono, ua hoikeia mai na huina a me kekahi wawae ona.

Eia ka huina i hoikeia mai ma E, 33 deg. 15 min. a me ka aoaomoe A E, 285 kapuai.

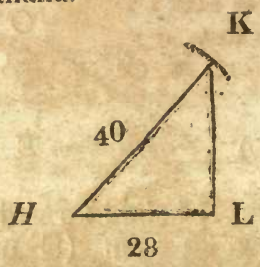


E kaha i ke kaha A E, 285 kapuai; ma A, e kukulu ae i ke kahakupono; ma E e kaha i ka huina 33 deg. 15 min. e hoonee aku i ka aoaoloa a i oki i ke kahakupono A L ma L.

NANEHAI 11.

E kaha i ka huinakolu kupono, ua hoikeia mai ka aoaoloa a me kekahi wawae ona

Eia ka aoaoloa i hoikeia mai H K, 40 anana a me ka aoaomoe H L, 28 anana.

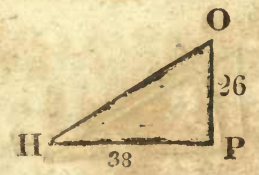


E kaha i kaha H L, 28 anana; ma L e kukulu ae i kahakupono; e wehe ae i ka upa ma ke kahakaulike ma ka rula i 40 anana, a hookahi wawae ma H, e kaha i ka pio e oki ana i ke kahakupono L K ma K; me ka rula e kaha i ke kaha H K, oia ka huinakolu kupono.

NANEHAI 12.

E kaha i ka huinakolu kupono, o kona mau wawae elua i hoikeia mai.

Eia ka wawae i hoikeia mai H P, 38 kapuai, a me ka wawae P O, 26 kapuai.

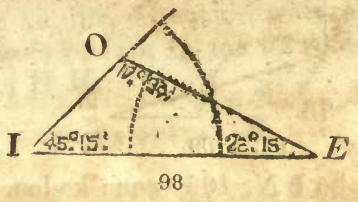


E kaha i ke kaha H P, 38 kapuai ka loa. Ma P e kaha i kahakupono, 20 kapuai mai P a i O; me ka rula e kaha i ke kaha H O.

NANEHAI 13.

E kaha i ka huinakoluhio, ua hoikeia mai na huina a me kekaki aoao ona.

Eia ka aoao i hoikeia mai I E, 98 anana ka loa, a me ka huina ma I 45 deg. 15 min. a me ka huina ma O 108 deg. 30 min. Alaila o ka huina ma E 26 deg. 15 min. no ia.



E kaha i ke kaha I E 98 anana ka loa. Ma I e ana i ka huina 45 deg. 15 min. a ma E e ana i ka huina 26 deg. 15 min. Alaila me ka rula e kaha i ke kaha I O a me O E.

NANEHAI 14.

E kaha i ka huinakoluhio, ua hoikeia mai na aoao ona elua a me ka huina eku e i kekahi o ia mau aoao.

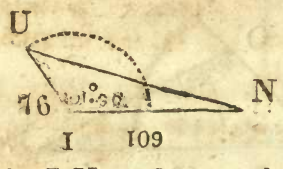
Eia ka aoao i hoikeia mai L E, 160 kapuai ka loa, a me ka aoao L A, 79 kapuai ka loa, a me ka huina ma E 29 deg. 9 min.

E kaha i ke kaha L E 160 kapuai ka loa. Ma E e kaha i ka huina 29 deg 9 min. Mai ke kahakaulike ma ka rula e lawe me ka upa 79 kapuai, a e kukulu i kekahi wawae ma L, a e kau i kela wawae ma ke kaha E A ma A, oia kekahi kihi o ka huinakoluhio. Alaila e kaha i ka aoao L A.

NANEHAI 15.

E kaha i ka huinakoluhio, ua hoikeia mai na aoao ona elua a me ka huina o ia mau aoao.

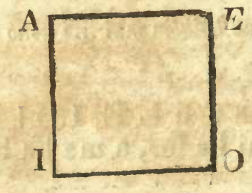
Eia ka aoao I N, 109 anana ka loa, a me ka aoao I U, 76 anana ka loa, a me ka huina ma I, 101 deg. 30 min.



E kaha i ke kaha I N, 109 anana ka loa. Mai I e kaha i ka huina 101 deg. 30 min. Mai I e ana i 76 anana a hiki i U. Alaila e kaha i ke kaha U N.

NANEHAI 16.

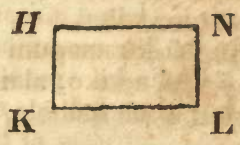
E kaha i ka huinahalike.



E kaha i ke kaha I O, a ma O e kukulu ae i ke kahakupono i like ka loa me I O. E wehe ae i ka upa e like me I O, a hookahi wawae ma E e kaha i ka pio ma A; me kela ano o ka upa, e kau i kekahi wawae ma I, a e kaha i ka pio e oki ana i kela pio ma A. Alaila me ka rula e kaha i ke kaha mai I a i A, mai A a i E.

NANEHAI 17.

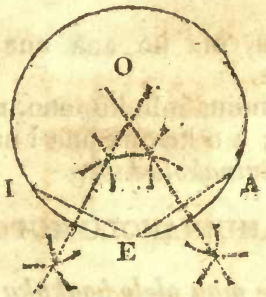
E kaha i ka huinahaloa.



E kaha i ke kaha K L, i like me ka aoaoloa o ka huinahaloa, a ma L e kukulu ae i ke kahakupono i like me ka aoao pokole o ua huinaha la. E ana i ka aoaoloa me ka upa, a hookahi wawae ma N, e kaha i ka pio ma *H.* Alaila e ana i ka aoao pokole me ka upa, a hookahi wawae ma K, e kaha i ka pio e oki ana i kela pio ma H; me ka rula e kaha i ke kaha H N a me ke kaha H K.

NANEHAI 18.

E kaha i ka poai e oki ana i na kiko ekolu aole i moe i ke kaha pololei, me I E A.



E kaha i ke kaha pololei mai I a i E, a mai E a i A; a e mahelelua i keia mau kaha. (E nana i ka NANEHAI 2.) A ma kahi e hui ai na mahele, oia no ka waenakonu o ka poai: a e kukulu i ka upa malaila e kaha i ka poai.

NANEHAI 19.

E imi i ke kikowaena o ka poai.

E kau i na kiko ekolu ma ke anapuni o ka poai, a e kaha i ke kaha mai kela kiko a i keia kiko; alaila e mahelelua i keia mau kaha, a ma kahi e hui ai na mahele, oia ke kikowaena o ka poai.

ANAHUINAKOLU.

O ke anahuinakolu, oia ke ana ana o na aoao a me na huina o na huinakolu.

O ke ana ana i na huinakolu kupono, ua kapaia'ku ia, he *anahuinakolu-kupono*; a o ke ana ana i na huinakolu-hio, ua kapaia'ku ia, he *anahuinakolu-hio*.

I. ANAHUINAKOLU-KUPONO.

He mau olelo hoakaka.

1. Ma ka huinakolu, eono no ano, ekolu aoao, ekolu huina.

2. O na huina a pau o ka huinakolu ke huiia, ua like ia me na huinakupono elua, 180 degere no ia. Nolaila, ina i ikeia na degere o kekahi huina, e unuhi mai ia mau degere aoloko mai o na degere 180, o ke koena, oia na degere o na

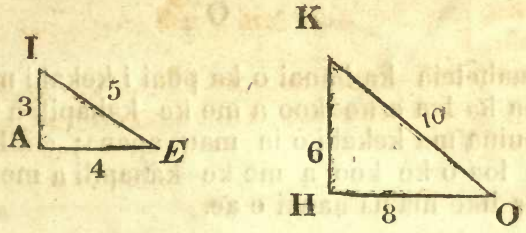
huina koe elua. Pela hoi, ina i ikeia na degere o na huina elua, e unuhi mai ia mau degere noloko mai o na degere 180, o ke koena, oia na degere o ka huina i koe.

Eia hoi kekahi, ma ka huinakolukupono, hookahi no huina kupono, a elua huina oi, o ka huinakupono, he 90 degere no ia; nolaila o na degere o na huina oi elua he 90 degere o laua. A ina i ikeia na degere o kekahi o keia mau huina oi, alaila e unuhi mai ia mau degere noloko mai o na degere he 90, o ke koena, oia na degere o ka huina i koe.

3. O ka loa o na aoao elua o ka huinakolu, ua oi aku laua ke huiia mamua o kekahi aoao.

4. O ka aoao loa o ka huinakolu, ua ku e aku ia i ka huina akea; o ka aoao pokole o ka huinakolu, ua ku e aku ia i ka huina uuku. A ma ka huinakolu hookahi, ua ku e aku na aoao like i na huina like.

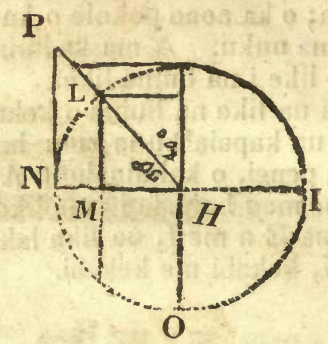
5 Ina ua like na huina o kekahi huinakolu me na huina o kekahi, ua kapaia'ku ia mau huinakolu, he mau huinakolu anolike; penei, o kahuinakolu A E I, a me kahuinakolu H O K, he mau huinakolu anolike laua; no ka mea, o na huina ma A ma E a me I, ua like lakou me na huina ma H ma O a me K, kekahi me kekahi.



6 O na aoao o na huinakolu anolike e ku e ana i na huina like, ua kapaia'ku lakou, he mau aoao anolike; penei, ma na huinakolu A E I a me H O K, me ka like ana o A E me H O, pela hoi ka like ana o E I me O K; a me A I me H K. Penei paha, me 4 : 8 :: 5 : 10 :: 3 : 6.

7. Ina i like na degere o kekahi mau pio o na poai like ole; ua kapaia'ku lakou, he mau pio anolike.

8. A, me ka like ana o ke koo a me ke kahapili a me ke kahaoki o ka pio o kekahi poai me ke koo a me ke kahapili a me ke kahaoki o ka pio anolike o kekahi poai, pela ka like ana o ka hanai o kela poai me ka hanai o keia poai. Penei, ina anolike ka pio A E o ka poai A E K H me ka pio L N o ka poai L N O I, alaila me ka like ana o ke koo A U me ke koo L M, a me ke kahapili O E me ke kahapili P N, a me ke kahaoki K O me H P; pela no ka like ana o ka hanai K H me ka hanai H I.



Nolaila, ina i maheleia ka hanai o ka poai i kekahi mau apana like, a i ikeia ka loa o ke koo a me ke kahapili a me ke kahaoki o ka huina ma kekahi o ia mau apana; alaila e hiki no ke loaa ka loa o ke koo a me ke kahapili a me ke kahaoki o ka huina like ma na hanai e ae.

He mau olelo hoakaka no ka imi ana i na aoao a me na huina o na huinakolu kupono.

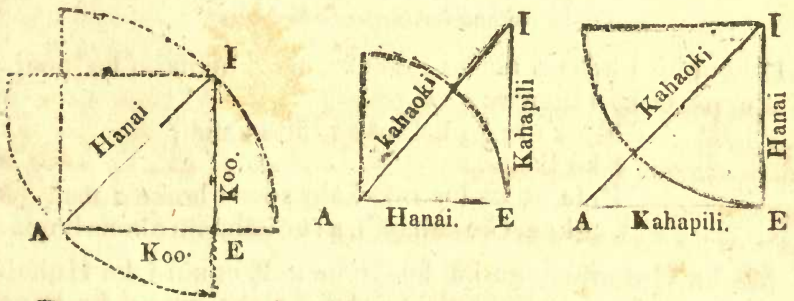
Ma ka huinakolu, eono no ano, ekolu aoao, a ekolu huina; a ina i ikeia ka loa o kekahi aoao a me na ano e ae elua, alaila e loaa no na mea i koe ke imi.

Ma ka manao ana, ua lilo kekahi aoao o ka huinakolu kupono i hanai o ka poai;

1. A ina i lilo ka aoaoloa i hanai, alaila, ua lilo ka aoaokupono a me ka aoaomoe i mau koo o na huina i ku e mai.

2. A ina i lilo ka aoaomoe i hanai, alaila, ua lilo ka aoaokupono i kahapili o ka huina i ku e mai; a ua lilo hoi ka aoaoloa i kahaoki o ua huina la.

3. A ina i lilo ka aoaokupono i hanai, alaila, ua lilo ka aoaomoe i kahapili o ka huina i ku e mai: a ua lilo hoi ka aoaoloa i kahaoki o ua huina la. O ke koo a me ke kahapili a me ke kahaoki o kekahi huina, oia hoi ke koo okoa, a me ke kahapili okoa, a me ke kahaoki okoa o kela huina.



Penei, ina ma ka huinakolu A E I, i hooliloia ka aoaoloa A I i hanai o ka poai, alaila, ua maopopo no, o ka aoao kupono E I, oia ke koo o ka huina ma A; a o ka aoaomoe A E, oia ke koo o ka huina ma I. A ina i hooliloia ka aoaomoe *A* E i hanai, alaila, o ka aoaokupono E I, oia ke kahapili o ka huina ma A; a o ka aoaoloa *A* I, oia ke kahaoki o ka huina ma *A*. A ina i hooliloia ka aoaokupono i hanai, alaila, o ka aoaomoe A E, oia ke kahapili o ka huina ma I; a o ka aoaoloa, oia ke kahaoki o ka huina ma I.

O na huina oi elua, o A a me I, he 90 degere laua ke huiia, nolaila, o ka huina ma A; he koena ia o ka huina ma I, a o ka huina ma I, he koena ia o ka huina ma A, nolaila hoi, o ke koo a me ke kahapili a me ke kahaoki o ka huina ma A, oia ke koo okoa a me ke kahapili okoa a me ke kahaoki okoa o ka huina ma I; a o ke koo a me ke kahapili a me ke kahaoki o ka huina ma I, oia ke koo okoa a me ke kahapili okoa a me ke kahaoki okoa o ka huina ma A.

No ka imi ana i ka loa o ka aoao.

E hoolilo i kekahi aoao i hanai o ka poai, a e kapa aku ia aoao, he hanai: alaila e kapa aku i kela mau aoao i ka inoa i pili ia laua e like me ka mea i hoikeia mai ma ka aoao 25. Alaila, penei ka like ana;

Me ka inoa o ka aoao i hoikeia mai.
I ka loa o ka aoao i hoikeia mai;
Pela no ka inoa o ka aoao e imi ai,
I ka loa o ka aoao e imi ai.

No ka imi ana i na degere o ka huina.

E hoolilo i kekahi aoao i hoikeia mai i hanai o ka poai. Alaila, penei ka like ana;

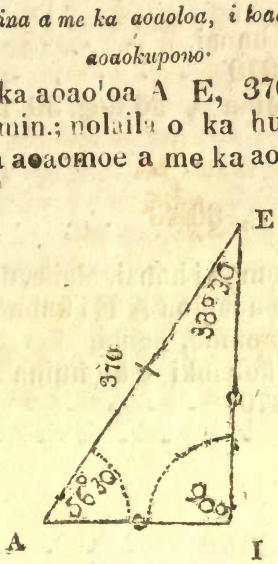
Me ka loa o ka aoao i lilo i hanai,
I ka hanai,
Pela no ka loa o kekahi aoao i hoikeia mai,
I ke koo, i ke kahapili, a i ke kahaoki o kona huina.

Ma ka Huhuihelu ka imi ana, penei: E unuhi i ka Huhuihelu o na mea ekolu i hoikeia mai, noloko mai o ka Papa Huhuihelu: alaila, e houluulu i ka mea lua a me ka mea kolu, a e hoolawe i ka mea mua noloko mai o na mea i houluuluia; a o ke koena, oia ka Huhuihelu o ka mea e imi ai. Alaila, ina he aoao ka mea e imi ai, e imi i ka Huhuihelu i loaa mai ma ka Papa 1 o na Huhuihelu, a malaila ua kakauia'i ka loa o ka aoao e imi ai. Ina he huina ka mea e imi ai, e imi i ka Huhuihelu i loaa mai ma ka Papa 2 o na Huhuihelu, a malaila ua kakauia'i na degere o ka huina e imi.

MOKUNA 1.

Ua hoikeia mai na huina a me ka aoaoloa, i loaa mai ka aoaomoe a me ka aoaokupono.

Ua hoikeia mai ka aoaoloa A E, 370 mile, a me ka huina ma A, 56 deg. 30 min.; nolaila o ka huina ma E, he 33 deg. 30 min. no ia; o ka aoaomoe a me ka aoaokupono, oia na mea o imi.



MA KE ANA ANA.

E kaha i ke kaha A I a ma A e kaha i ka huina 56 deg. 30 min. (NANEHAI 6.) Mai A a i E e ana 370 mile ma na kaha kaulike ma ka rula; oia ka loa o ka aoaoloa. Ma E e hookuu i ke kahakupono E I (NANEHAI 4.) a ua paa ka huinakolu A E I. Alaila, e ana i ka aoaomoe A I me ka upa ma na kahakaulike ma ka rula, 204.2 mile no ia; a e ana hoi i ka aoaokupono I E, 308.6 mile no ia.

MA KA HELU ANA.

E hoolilo i ka aoaoloa i hanai, alaila, ua lilo A I i koo o ka huina ma E, a ua lilo I E i koo o ka huina ma A, (e nana i ka aoao 25, pauku 1.) Alaila e imi i ka aoaomoe, penei;

Me ka like ana o ka hanai - - - - - - - - -	10.00000
I ka aoaoloa A E, 370 - - - - - - - -	2.56820
Pela no ke koo o ka huina E 33 deg. 30 min. - -	9.74189
	12.31009
	10.10000
I ka aoaomoe A E 204.2 - - - - - - - - -	2.31009

E imi i ka aoaokupono, penei;

Me ka like ana o ka hanai. - - - - - - -	10.00000
I ka aoaoloa A E 370 - - - - - - - -	2.56820
Pela ke koo o ka huina A 56 deg. 30 min·	9.92111
	12.48931
	10.00000
I ka aoaokupono A E, 308.6	2.84931

E hoolilo i ka aoaomoe i hanai, alaila, ua lilo ka aoaokupono I E i kahapili; a o ka aoaoloa A E i kahaoki o ka huina ma A. Alaila, e imi i ka aoaomoe, penei;

Me ka like ana o ke kahaoki o ka huina A, 56 30.	10.25811
I ka aoaoloa A E 370 - - - - - - - - -	2.56820
Pela no ka hanai - - - - - - - - - -	10.00000
	12.56820
	10.25811
I ka aoaomoe A I 204.2 - - - - - - -	2.31009

E imi i ka aoaokupono, penei;

Me ka like ana o ke kahaoki o ka huina A 56 30	10.25811
I ka aoaoloa A E, 370	2.56820
Pela no ke kahapili o ka huina A, 54 deg. 30 min. -	10.17922
	12.74742
	10.25811
I ka aoaokupono I E 308.6	2.48931

E hoolilo i ka aoaokupono I E i hanai, alaila, ua lilo ka aoaomoe A I i kahapili, a me ka aoaoloa i kahaoki o ka huina ma E. Alaila e imi i ka aoaomoe, penei;

Me ka like ana o ke kahaoki o ka huina E 33 30.	10.07889
I ka aoaoloa A E 370	2.56820
Pela no ke kahapili o ka huina E 33 deg. 30 min. -	9.82078
	12.38898
	10.07889
I ka aoaomoe A I, 204.2	2.31009

E imi i ka aoaokupono penei;

Me ka like ana o ke kahaoki o ka huina E, 33 30	10.07889
I ka aoaoloa A E, 370 - - - - - - - - - -	2.56820
Pela no ka hanai - - - - - - - - - - - -	10.00000
	12.56820
	10.07889
I ka aoaokupono I E, 308.6 - - - - - - - -	2.48931

MA KA RULA.

E imi i ka aoaomoe, penei;

Ma ka lalani koo ma ka rula, e kau i kekahi wawae o ka upa, ma ke 90 deg., a e kau i kela wawae ma ke degere o ka huina E, 33 30. A ma ka lalani helu, me kela wehe ana no o ka upa, e kau i kekahi wawae ma ke 370, oia ka aoaoloa: alaila ma kahi e kauia'i kela wawae, malaila i kakauia'i ka loa o ka aoaomoe, 204.2.

E imi i ka aoaokupono penei;

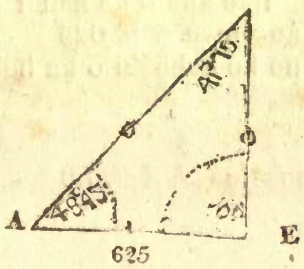
Ma ka lalani koo ma ka rula, e kau i kekahi wawae o ka upa ma ke 90 deg., a e kau i kela wawae ma ka degere o ka huina *A* 56 30· *A* ma ka lalani helu. me kela wehe ana o ka upa, e kau i kekahi wawae ma ke 370, oia ka aoaoloa; alaila ma kahi i kauia'i kela wawae, malaila i kakauia'i ka loa o ka aoaokupono, 308.6.

MOKUNA 2.

Ua hoikeia mai na huina a me kekahi wawae i loaa ka aoaoloa a me ka lua o ka wawae.

Ua hoikeia mai ka aoaomoe A E 625 kapuai, a me ka huina A 48 deg. 45 min.; o ka aoaoloa a me ka aoaokupono, oia na mea e imi ai.

	90 00
Huina *A*	48 45
Huina I	41 15



MA KE ANA ANA.

E kaha i ka aoaomoe A E 625 kapuai ka loa; ma E e kukulu ae i ke kahakupono E I. (NAEHAI 3.) A e ana i ka huina ma A 48 deg. 45 min. (NANEHAI 6.) E kaha i ka aoaoloa mai A aku a i I. Alaila e ana i ka aoaomoe A E ma ke kahakaulike ma ka rula, 947.9 kapuai no ia; a e ana hoi i ka aoaokupono E I. 712.7 kapuai oia.

MA KA HELU ANA.

E hoolilo i ka aoaoloa i hanai, alaila, ua lilo ka aoaomoe A E i koo o ka huina ma I, a ua lilo ka aoaokupono E I i koo o ka huina ma A. Alaila e imi i ka aoaoloa penei;

Me ka like ana o ke koo o ka huina I 41 15 - -	9.81911
I ka aoaomoe A E 625 - - - - - - - - - -	2.79588
Pela no ka hanai - - - - - - - - - -	10.00000
	12.79588
	9.81911
I ka aoaoloa A I 947.9 - - - - - - - - -	2.97677

E imi i ka aoaokupono penei;

Me ka like ana o ke koo o ka huina I 41 deg 15 min.	9.81911
I ka aoaomoe A E 625 - - - - - - - - -	2.79588
Pela no ke koo o ka huina A 48 deg. 45 min - -	9.87012
	12.67200
	9.81911
I ka aoaokupono E I 712 7 - - - - - - -	2.85289

E hoolilo i ka aoaomoe i hanai, alaila, ua lilo ka aoaokupono i kahapili, a o ka aoaoloa i kahaoki o ka huina A. Alaila e imi i ka aoaoloa penei;

Me ka like ana o ka hanai - - - - - - - -	10.00000
I ka aoaomoe A E 625 - - - - - - - - -	2.79588
Pela no ke kahaoki o ka huina A 48 deg. 45 min.	10.18089
	12.97677
	10.00000
I ka aoaoloa A I 947.9 - - - - - - - - -	2.97677

E imi i ka aoaokupono penei:

Me ka like ana o ka hanai - - - - - - - -	10.00000
I ka aoaomoe A E 625 - - - - - - - -	2.79588
Pela no ke kahapili o ka huina A 48 deg. 45 min.	10.05701
	12.85289
	10.00000
I ka aoaokupono E I 712.7 - - - - - - - -	2.85289

E hoolilo i ka aoaokupono i hanai, alaila, ua lilo ka aoaomoe A E i kahapili, a me ka aoaoloa A I i kahaoki o ka huina I. Alaila e imi i ka aoaoloa penei;

Me ka like ana o ke kahapili o ka huina I 41 15	9.94299
I ka aoaomoe A I 625 - - - - - - - -	2.79588
Pela no ke kahaoki o ka huina I 41 deg. 15 min.	10.12387
	12.91975
	9.94299
I ka aoaoloa A I 947.9 - - - - - - - -	2.97676

E imi i ka aoaokupono penei;

Me ka like ana o ke kahapili o ka huina I 41 15	9.94299
I ka aoaomoe A E 625 - - - - - -	2.79588
Pela no ka hanai	10.00000
	12.79588
	9.94299
I ka aoaokupono E I 712.7	2.85289

MA KA RULA.

E imi i ka aoaoloa penei;

Ma ka lalani koo ma ka rula, e kau i kekahi wawae o ka upa, ma ke 90 deg., a e kau i kela wawae ma ke degere o ka huina I 41 15 A ma ka lalani helu, me kela wehe ana no o ka upa, e kau i kekahi wawae ma ke 625, oia ka aoaomoe; alaila ma ka lalani e kauia' kela wawae, malaila i kakauia'i ka loa o ka aoaoloa 947 9.

E imi i ka aoaokupono penei;

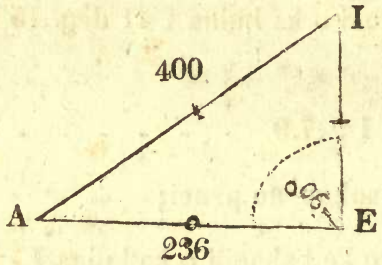
Ma ka lalani koo ma ka rula, e kau i kekahi wawae o ka

upa ma ka huina I 41 deg. 15 min., a e kau i kela wawae ma ka huina A, 48 deg 45 min. A ma ka lalani helu, me kela wehe ana no o ka upa, e kau i kekahi wawae ma ke 625, oia ka aoaomoe; alaila, ma kahi i kauia'i kela wawae, malaila i kakauia'i ka loa o ka aoaokupono 712.7.

MOKUNA 3.

Ua hoikeia mai ka aoaoloa a me kekahi wawae i loaa ka lua o ka wawae a me na huina.

Ua hoikeia mai ka aoaoloa A $\frac{1}{}$, 400 anana, a me ka aoaomoe E A 236 anana; o ka aoaokupono E I a me ka huina A a me ka huina I, oia na mea e imi ai.



MA KE ANA ANA.

E kaha i ka aoaomoe E A, 236 anana ka loa. Ma E e kukulu ae i ke kahakupono E I, (NANEHAI 3.) Ma na kaha kaulike ma ka rula, e lawe me ka upa i ke 400 anana; e kau i kekahi wawae ma A, a e kaha i ka pio e oki i ke kahakupono ma I, a e kaha i ke kaha A I. Alaila, ma ke kaha kaulike ma ka rula, e ana i ka aoaokupono E I, 323 anana no ia, a e ana hoi i ka huina I, 36 deg. 9 min. oia, (NANEHAI 7.) no-laila o ka huina A, 53 deg. 51 min. no ia; no ka mea, oia ke koena o ka huina I.

MA KA HELU ANA

A hoolilo i ka aoaoloa i hunai, alaila, ua lilo ka aoaomoe A E i koo o ka huina I, a ua lilo ka aoaokupono E I i koo o ka huina A. Alaila e imi i na huina penei;

Me ka like ana o ka aoaoloa A I 400 . . 2.60206
I ka hanai 10.00000
Pela no ka aoaomoe E A 236 . . . . . 2.37291

12.37291
90 0 2.60206
I ke koo o ka huina I 36 9 9.77085
Huina A 53 51

E imi i ka aoaokupono penei,
Me ka like ana o ka hanai 10.00000
I ka aoaoloa A I 400 . . . . . 2.60206
Pela no ke koo o ka huina A 53 deg 51 min. 9.90713

12.50919
10.00000
I ka aoaokupono E I 323 . . . . . 2.50919

E hoolilo i ka aoaomoe i hanai, alaila, ua lilo ka aoaokupono i kahapili, a o ka aoaoloa i kahaoki o ka huina A. Alaila e imi i na huina penei:
Me ka like ana o ka aoaomoe E A 236. . . 2.37291
I ka hanai 10.00000
Pela no ka aoaoloa 400 . . . . . 2.60206

12.60206
90 00 2.37291
I ke kahaoki o ka huina A 53 51 10.22915
Huina I 36 9
E imi i ka aoaokupono penei:
Me ka like ana o ka hanai 10.00000
I ka aoaomoe E A 236 . . . . . 2.37291
Pela ke kahapili o ka huina A 53 deg. 51 min. 10.13635

12.50926
10.00000
I ka aoaokupono E I 323 . . . . . 2.50926

MA KA RULA.

E imi i na huina penei:

Ma ka lalani helu ma ka rula, e kau i kekahi wawae o ka upa ma ka 400, a e kau i kela wawae ma ke 236. Ma ka lalani koo, me kela wehe ana o ka upa, e kau i kekahi wawae ma ke 90 deg.; alaila, ma kahi i kauia'i kela wawae malaila i kakauia'i na degere o ka huina I 36 deg. 9 min. E hoolawe ia mau degere noloko mai o ke 90, a puka mai 53 deg. 51 min. oia ka huina A.

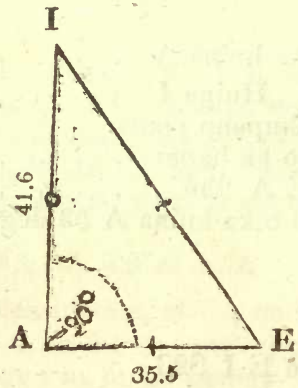
E imi i ka aoaokupono penei;

Ma ka lalani koo ma ka rula, e kau i kekahi wawae o ka upa ma ke 90 deg., a e kau i kela wawae ma ke degere o ka huina A 53 51. Ma ka lalani helu, me kela wehe ana no o ka upa, e kau i kekahi wawae ma ka 400, oia ka aoaoloa; alaila; ma kahi e kauia'i kela wawae, malaila i kakauia'i ka loa o ka aoaokupono, 323.

MOKUNA 4.

Ua hoikeia mai ka aoaomoe a me ka aoaokupono i loaa na huina a me ka aoaoloa.

Ua hoikeia mai ka aoaomoe A E 35.5, a me ka aoaokupono A I 41.6; o ka huina E a me I, a me ka aoaoloa E I, oia na mea e imi ai.



MA KE ANA ANA.

E kaha i ka aoaomoe A E 35.5 kaulahao ka loa; ma A e kukulu ae i ke kahakupono A I 41.6 ka loa, (NANEHAI 3.) A e kaha i ke kaha E I. Alaila, ma ke kaha kaulike ma ka rula, e ana i ka aoaoloa E I, 54.7 kaulahao oia; e ana hoi i ka huina E, (NANEHAI 7.) 49 deg. 31 min. oia, nolaila o ka huina I 40 deg. 29 min. oia. (E nana i ka aoao 22, pauku 2.)

MA KA HELU ANA.

E hoolilo i ka aoaomoe i hanai, alaila, ua lilo ka aoaokupono A I i kahapili o ka huina E, a ua lilo ka aoaoloa i kahaoki o ua huina la. Alaila e imi i na huina penei;

Me ka like ana o ka aoaomoe A E 35.5 . .	1.55023
I ka hanai	10.00000
Pela no ka aoaokupono A I 41.6	1.61909
	11.61909
	1.55023
I ke kahapili o ka huina E 49 31	10.06886
90 00	
Huina I. 40 29	

E imi i ka aoaoloa penei;

Me ka like ana o ka hanai	10.00000
I ka aoaomoe A E 35.5	1.55023
Pela no ke kahaoki o ka huina E 49 deg. 31 min.	10.18760
	11.73783
	10.00000
I ka aoaoloa E I 54.68	1.73783

E hoolilo i ka aoaokupono i hanai, alaila, ua lilo ka aoaomoe A E i kahapili o ka huina I, a me ka aoaoloa E I i kahaoki o ua huina la. Alaila e imi i na huina penei;

Me ka like ana o ka aoaokupono A I 41.6 . .	1.61909
I ka hanai	10.0 0 0
Pela no ka aoaomoe A E 35.5.	1 55023
	11.55023
	1.61909
I ke kahapili o ka huina I 40 29	9.93114
90 00	
Huina E 49 31	
E imi i ka aoaoloa penei;	
Me ka like ana o ka hanai - - - - - - - -	10.00000
I ka aoaokupono A I 41.6 - - - - - - - -	1.61909
Pela no ke kahaoki o ka huina I 40 29 - -	10.11885
	11.73794
	10.00000
I ka aoaoloa E I 54.69 - - - - - - - - -	1.73794

MA KA RULA.

Ma ka lalani helu ma ka rula, e kau i kekahi wawae o ka upa ma ka aoaomoe 35.5, a e kau i kela wawae ma ka aoaokupono 41.6. Me kela wehe ana o ka upa, e kau i kekahi wawae ma ke 45 deg. ma ka lalani kahapili; alaila, ma kahi i kauia'i kela wawae, malaila i kakauia'i na degere o ka huina E 49 31. E hoolawe ia mau degere noloko mai o ke 90, a koe mai 40 deg. 29 min. oia ka huina I.

E imi i ka aoaoloa penei;

Ma ka lalani koo ma ka rula e kau i kekahi wawae o ka upa ma ke degere o ka huina I 40 29, a e kau i kela wawae ma ke 90 degere. Ma ka lalani helu me kela wehe ana no o ka upa, e kau i kekahi wawae ma ka aoaomoe 35.5; alaila ma kahi e kauia'i kela wawae, malaila i kakauia'i ka loa o ka aoaoloa 54.68.

NA UI HOILIILI.

1. Ua hoikeia mai ka aoaoloa 108 kapuai, a me ka huina i ku e i ka aoaokupono, 25 deg. 36 min. E imi i ka aoaomoe a me ka aoaokupono.

O ka aoaomoe 97.4 kapuai no ia,o ka aoaokupono 46.6 oia.

2. Ua hoikeia mai ka aoaomoe 96 kaulahao, a me ka huina i ku e ana 71 deg. 45 min. E imi i ka aoaokupono a me ka aoaoloa.

O ka aoaokupono 31.6 kaulahao no ia; o ka aoaoloa 101.1 kaulahao oia.

3. Ua hoikeia mai ka aoaokupono 360 anana, a me ka huina i ku e ana 58 deg. 20 min. E imi i ka aoaomoe a me ka aoaoloa.
O ka aoaomoe 222 anana no ia, o ka aoaoloa 423 oia.

4. Ua hoikeia mai ka aoaomoe 720 mile a me ka aoaoloa 980. E imi i na huina a me ka aoaokupono.

O kekahi huina 47 deg. 17 min; a 42 deg. 43 o kekahi. O ka aoaokupono 664.8 mile oia.

5. Ua hoikeia mai ka aoaokupono 110.3 kaulahao, a me ka aoaoloa 176.5. E imi i na huina a me ka aoaomoe.

O kekahi huina 38 deg. 41 min. no ia; o kekahi 51 deg. 19 min. oia. O ka aoaomoe 137.8 kaulahao no ia.

6. Ua hoikeia mai ka aoaomoe 360 anana a me ka aoaokupono 480. E imi i na huina a me ka aoaoloa.

O kekahi huina 53 deg. 8 min. no ia: a o kekahi 36 deg. 52 min. oia. A o ka aoaoloa 600 anana oia.

7. Ua hoikeia ka aoaoloa 496 mile, a me ka huina i ku e i ka aoaomoe 56 deg. 15 min. E imi i ka aoaomoe a me ka aoaokupono.

O ka aoaomoe 412.4 mile no ia, a o ka aoaokupono 275.6 mile oia.

8. Ua hoikeia mai ka aoaokupono 275 Setadia, a me ka huina i ku e i ka aoaomoe 56 deg. 15 min. E imi i ka aoaoloa a me ka aoaomoe.

O ka aoaoloa 495 Setadia oia, a o ka aoaomoe 411.6 no ia.

9. Ua hoikeia mai ka aoaomoe 33 iwilei, a me ka huina i ku e i ka aoaokupono 53 deg. 26 min. E imi i ka aoaoloa a me ka aoaokupono.

O ka aoaoloa 55.4 iwilei oia, o ka aoaokupono 44.5 oia.

10. Ua hoikeia mai ka aoaoloa 575 mile, a me ka aoaokupono 50 mile. E imi i ka aoaomoe.

O ka aoaomoe 572.8 mile.

11. Ua hoikeia ka aoaoloa 59 anana a me ka aoaomoe 33 anana. E imi i ka aoaokupono.

O ka aoaokupono 48.9 anana.

12. Ua hoikeia mai ka aoaomoe 33 kapuai, a me ka aoaokupono 52 kapuai. E imi i ka aoaoloa.

O ka aoaoloa 61.6 kapuai.

13. Ua hoikeia mai ka aoaokupono 91 mile, a me ka aoaoloa 170 mile. E imi i na huina a me ka aoaomoe.

O kekahi huina 32 deg. 22 min. oia, a o kekahi 57 deg. 38 min. oia. A o ka aoaomoe 143.6 mile no ia.

14. Ua hoikeia mai ka aoaomoe 707 anana, a me ka aoaokupono 890 anana. E imi i na huina a me ka aoaoloa.

O kekahi huina 51 deg. 32 min. oia, a o kekahi 38 deg. 28 min. oia.

15. Ua hoikeia mai ka aoaokupono 325 mile, a me na huina 33 deg. 15 min. kekahi, 56 deg. 45 min. kekahi. E imi i ka aoaoloa a me ka aoaomoe.

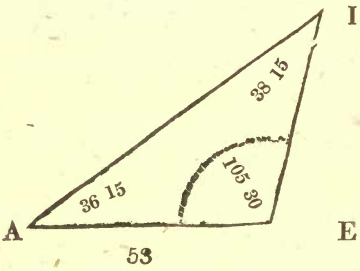
16. Ua hoikeia mai ka aoaoloa 50 degere a me ka aoaokupono 40 degere. E imi i na huina a me ka aoaomoe.

ANAHUINAKOLU-HIO.

MOKUNA 1.

Ua hoikeia mai na huina a me kekahi aoao i loaa kela mau aoao elua.

Ua hoikeia mai huina A 36 deg. 15 min. a me ka huina E 105 deg. 30 min., a me ka aoao A E 53 anana. E imi i ka aoao A I a me ka aoao E I.



Huina E	105	30
Huina A	36	15
	141	45
	180	00
Huina I	38	15

MA KE ANA ANA.

E kaha i ke kaha A E 53 anana ka loa; a e kaha i ka huina ma A 36 deg. 15 min., a e kaha hoi i ka huina ma E 105 deg. 30 min. (NANEHAI 6,) a e hoopanee aku i na aoao a oki kekahi i kekahi ma I. Alaila ma na kaha kaulike ma ka rula, e ana i ka aoao A I, 82.5 anana no ia, a e ana hoi i ka aoao E I, 50.6 oia.

MA KA HELU ANA.

E imi i ka aoao A I penei;

Me ka like ana o ka huina I 38. 15. . . . . 9.79176
I ka aoao A E 53 anana. 1.72428
Pela no ke koo o ka huina E 105 deg. 30 min. . 9.98391

11.70819
9.79176

I ka aoao A I 82.5 anana 1.91643

E imi i ka aoao E I penei;
Me ka like ana o ka huina I 38 15 . . . . . 9.79176
I ka aoao A E 53 anana. 1.72428
Pela no ke koo o ka huina A 36 15. . . . . 9.77181

11.49609
9.79176

I ka aoao E I 50.6 anana. 1.70433

MA KA RULA.

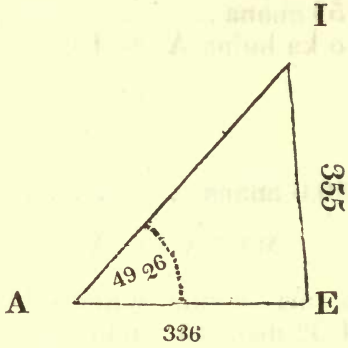
Ma ka lalani koo ma ka rula, e kau i kekahi wawae o ka upa ma ka huina I 38 deg. 15 min., a e kau i kela wawae ma ke 74 deg. 30 min., oia ka piha o ka huina E. Me kela wehe ana o ka upa, ma ka lalani helu e kau i kekahi wawae ma ka aoao A E, 53 anana; alaila, ma kahi i kauia'i kela wawae, malaila i kakauia'i ka loa o ka aoao A I, 82.5 anana oia.

Ma ka lalani koo ma ka rula, e kau i kekahi wawae o ka upa ma ka huina I 38 deg. 15 min., a e kau i kela wawae ma ka huina A 36 deg. 15 min. Me kela wehe ana o ka upa, ma ka lalani helu e kau i kekahi wawae ma ka aoao A E 53 anana; alaila, ma kahi i kauia'i kela wawae, malaila i kakauia'i ka loa o ka aoao E I, 50.6 anana oia.

MOKUNA 2.

Ua hoikeia mai na aoao elua a me ka huina i ku e i kekahi o laua, i loaa mai na huina a me ka aoao i koe.

Ua hoikeia mai ka aoao A E 336 kaulahao, a me ka aoao E I 355 kaulahao, a me ka huina A 49 deg. 26 min. E imi i ka huina E a me ka huina I a me ka aoao A I.



MA KE ANA ANA.

E kaha i ke kaha A E 336 kaulahao ka loa. Ma A e kaha i ka huina 49 deg. 26 min. (NANEHAI 6.) Ma ke kaha kaulike ma ka rula, e lawe i ka aoao E I 355 kaulahao me ka upa; a e kau i kekahi wawae ma E, a e oki i ka aoao A I ma I, a e kaha i ka aoao E I. Alaila, me ka upa ma ka rula, e ana i ka huina ma E, 84 deg. 36 min. oia, a e ana hoi i ka huina ma I 45 deg. 58 min. oia. (NANEHAI 7.) A ma ka rula, e ana hoi i ka aoao A I 465.3 kaulahao no ia.

MA KA HELU ANA.

E imi i ka huina I, penei;
Me ka like ana o ka aoao E I 355. . . . . 2.55023
I ke koo o ka huina A 49 deg. 26 min. 9.88061

Pela no ka aoao A E 336. . . . . 2.52634

12.40695
2.55023

I ke koo o ka huina I 45 58 — 9.85672
Huina A 49 26
Ka hui pu ana 95 24
180 00
Huina E 84 36

E imi i ka aoao A I, penei;
Me ka like ana o ka huina A 49 26. . . . . 9.88061
I ke koo E I 355. . . . . 2.55023
Pela no ke koo o ka huina E 84 36. . . . . 9.99807

12.54830
9.88061

I ka aoao A I 465.3. . . . . 2.66769

MA KA RULA.

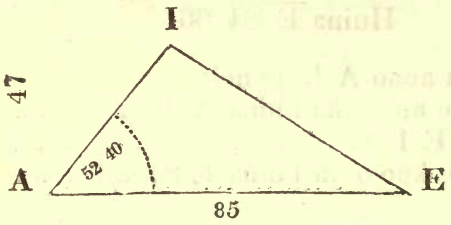
Ma ka lalani helu, e kau i kekahi wawae o ka upa ma ke 355, oia ka aoao E I, a e kau i kela wawae ma ke 336, oia ka aoao A E. Me kela wehe ana o ka upa, ma ka lalani koo, e kau i kekahi wawae o ka upa ma ka huina A 49 deg. 26 min.; alaila ma kahi i kauia'i kela wawae, malaila i kakauia'i na degere o ka huina I 45 58. Nolaila, o ka huina E 84 deg. 36 min. no oia. (*E nana i ka aoao* 22,*pauku* 2.)

Ma ka lalani koo, e kau i kekahi wawae o ka upa ma ka huina A 49 deg. 26 min., a e kau i kela wawae ma ka huina E 84 deg. 36 min. Me kela wehe ana o ka upa, ma ka lalani helu, e kau i kekahi wawae ma ka aoao E I 355; alaila, ma kahi i kauia'i kela wawae, malaila i kakauia'i ka aoao A I 465.3.

MOKUNA 3.

Ua hoikeia mai na aoao elua a me ka huina mawaena o laua, i loaa mai kela mau huina a me ka aoao i koe.

Ua hoikeia mai ka aoao A E 85 mile, a me ka aoao A I 47 mile, a me ka huina A 52 deg. 40 min. E imi i ka huina I a me ka huina E, a me ka aoao E I.



MA KE ANA ANA.

E kaha i ke kaha A E 85 mile ka loa; ma A e kaha i ka huina 52 deg. 40 min. Mai A a i I e ana 47 mile. A mai I a i E e kaha i ka aoao E I. Alaila ma ka rula, e ana i ka huina E, 33 deg. 29 min. oia; e ana hoi i ka huina I, 93 deg. 51 min. oia. (NANEHAI 7.) E ana hoi i ka aoao E I, 67.7 mile oia.

MA KA HELU ANA.

E houluulu i ka aoao A E 85 a me ka aoao A I 47, a loaa mai ka hui pu ana 132. A e hoolawe i ka aoao A I 47 noloko mai o ka aoao A E 85, a koe mai 38.

E hoolawe i ka huina A 52 deg. 40 min. noloko mai o ka 180 deg. a koe mai 127 deg. 20 min, oia ka hui pu ana o na huina o E a me I. (*E nana i ka aoao 22 pauku* 2.) O ka hapalua o kela mau huina, 63 deg. 40 min. no ia. Alaila, e imi i na huina penei;

Me ka like ana o ka hui pu ana o na aoao A E a me A I } 132. . . . . 2 12057

I ke koena o laua 38. . . . . 1.57978
Pela no ke kahapili o ka hapalua o ka hui pu ana o na huina E a me I. } 63 40 . 10.30543

11 88521
I ke kahapili o ka hapalua o ke koena o laua . . . . . } 30 11. . 2.12057 9.76464

E houluulu i ka mea i loaa mai 30 deg. 11 min. me ka hapalua o ka hui pu ana o na huina E a me I 63 deg. 40 min., a loaa mai 93 deg. 51 min., oia ka huina nui o I. A e hoolawe 30 deg. 11 min. noloko mai o ke 63 deg. 40 min, a loaa mai ka huina uuku o E 33 deg. 29 min.

E imi i ka aoao E I penei;
Me ka like ana o ke koo o ka huina E 33 29. - - 9.74170
I ka aoao A I 47 . - - - - - - - - - - - - - - - 1.67210
Pela no ke koo o ka huina A 52 40 . - - - - - - 9.90043

11.57253
9.74170

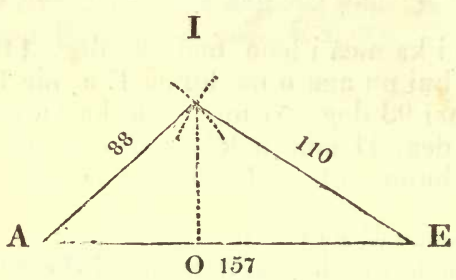
I ka aoao E I 67.7. - - - - - - - - - - - - - - - 1.83083

Eia kekahi hana ana. E hookuu i ke kaha kupono mai I a ku mawaena o ke kaha A E, alaila, ua lilo ka huinakolu A E I i alua mau huinakolu kupono. Alaila, me ka aoaoloa A I a me ka huina A, e imi i ka aoaokupono a me ka aoaomoe o kekahi huinakolu. E hoolawe i ka aoaomoe noloko mai o ka aoao A E, a koe mai ka aoaomoe o kela huinakolu. Alaila, me ka aoaoakupono a me ka aoaomoe, e imi i ka huina E; a e houluulu i ka huina E a me ka huina A, a e hoolawe ia mau huina i hui pu ia noloko mai o na degere 180, o ke koena, oia ka huina I. Alaila, me ka huina E a me ka aoaokupono e imi i ka aoao E I.

MOKUNA 4.

Ua hoikeia mai na aoao ekolu i loaa mai na huina.

Ua hoikeia mai ka aoao A E 157 mile, a me ka aoao E I 110 mile, a me ka aoao A I 88 mile. E imi i na huina A, E, a me I.



MA KE ANA ANA.

E kaha i ke kaha A E 157 mile. Ma ke kaha kaulike ma ka rula, e lawe me ka upa i ka aoao A I 88, a e kau i kekahi wawae ma A, a e kaha i ka pio ma I. Pela hoi e lawe i ka aoao E I, a e kau i kekahi wawae ma E, a e kaha ika pio e oki ana i kela pio ma I. A e kaha i ke kaha A I a me E I. Alaila, e ana ma ka rula i ka huina A, 42 deg. 44 minute oia. Pela hoi i ka huina E, 32 deg. 53 min. oia, a me ka huina I, 104 deg. 23 min. oia. (NANEHAI 7.)

MA KA HELU ANA.

E houluulu i ka aoao A I 88, a me ka aoao E I 110; o ka hui pu ana 198 oia. E hoolawe i ka aoao A I 88 noloko o ka aoao I E 110, a koe mai 22.

E imi i na apana A O, a me O E penei;
Me ka like ana o ka aoaomoe loihi A E, 157. - - 2.19590
I ka hui pu ana o na aoao A I a me E I 198. - - 2.29666
Pela hoi ke koena o kela mau aoao A I a me E I 22 } 1.34242

I ke koena o na apana A O a me O E 27.7. - - - 1.44318

E hui pu i ka hapalua o keia koena 13.9 me ka hapalua o ka aoaomoe A E 78.5, a loaa mai 92.4, oia ka apana nui O E. E hoolawe i ka 13.9 noloko mai o ka 78.5, a koe mai 64.6, oia ka apana uuku A O.

E imi i na huina penei;
Me ka like ana o ka aoao A I 88. - - - - - - - - 1.94448
I ka hanai . - 10.00000
Pela hoi ka apana A O 64.6. - - - - - - - - - - - 1.81043

11.81043
1.94448

90 00
I ke koo o ka huina A I O 47 deg. 16 min. - - 9.86595
Huina I A O 42 deg. 44 min.

Me ka like ana o ka aoao E I 110. - - - - - - - 2.04139
I ka hanai . - 10.00000
Pela hoi ka apana O E 92.4. - - - - - - - - - - - 1.96553

11.96553
2.04139

90 00
I ke koo o ka huina E I O 57 7 . - - - - - - - 9.92414
Huina I E O 32 53

Huina A I O 47 16
Hunia E I O 57 7
Huina A I E 104 23

MA KA RULA.

Ma ka lalani helu ma ka rula, e kau i kekahi wawae o ka upa ma ka aoaomoe A E 157, a e kau i kela wawae ma ka hui pu ana o na aoao A I a me I E 108. A me kela wehe ana o ka upa, e kau i kekahi wawae ma ke koena 22, a ma

kahi i kauia'i kela wawae, oia ke koena o na apana A O, O E 27.7. Alaila, e imi i ka loa o na apana A O a me O E e like me mamua.

Ma ka lalani helu, e kau i kekahi wawae ma A I 88, a e kau i kela wawae ma ka apana uuku A O 64.6. Me kela wehe ana o ka upa, ma ka lalani koo e kau i kekahi wawae ma ke 90 deg, a ma kahi i kauia'i kela wawae, malaila i kakauia'i ka huina A I O 47 deg. 16 min. Nolaila o ka huina I A O 42 deg. 44 min. no ia.

Ma ka lalani helu, e kau i kekahi wawae o ka upa ma ka aoao I E 110, a e kau i kela wawae ma ka apana nui 92.4. Me kela wehe ana o ka upa, ma ka lalani koo e kau i kekahi wawae ma ke 90, a ma kahi i kauia'i kela wawae, malaila i kakauia'i ka huina O I E 57 deg. 7 min. Nolaila o ka huina I E O 32 deg. 53 min no ia.

NA UI HOILIILI.

1. Ua hoikeia mai kekahi aoao 129 mile, a me kekahi huina i ku e ana 81 deg. 33 min., a me kekahi huina e ae 56 deg. 30 min. E imi i ke kolu o na huina, a me kela mau aoao elua.

O ke kolu o ka huina 41 deg. 54 min. oia. O kekahi aoao 108.7 mile ia, a o kekahi 87.1 mile no ia.

2. Ua hoikeia mai na aoao elua 96.5 anana o kekahi, 59.7 anana o kekahi, a me ka huina e ku e ana i kela aoao nui, 57 deg. 33 min. E imi i na huina a me ka aoao i koe.

O kekahi huina 31 deg 30 min. no ia; a o kekahi 90 deg. 52 min. oia; o ka aoao i koe 114.2 anana no ia.

3. Ua hoikeia mai kekahi aoao 110 kaulahao, a me kekahi aoao 102 kaulahao, a me ka huina mawaena o laua. E imi i na huina a me ka aoao i koe.

O na huina i koe 34 deg. 37 min. o kekahi, 31 deg. 47 min. o kekahi; o ka aoao 177.5 kaulahao oia.

4. Ua hoikeia mai na aoao a pau 120.6 mile o kekahi, 125.5 o kekahi, 146.7 o kekahi. E imi i na huina.

O kekahi huina 51 deg. 53 min.; 54 deg. 58 min. o kekahi; 73 deg. 9 min. o kekahi.

NO KE ANAKIEKIE A ME KE ANALOA.

1. O ke anakiekie, oia ke ana ana i ke kiekie o na hale, a me na puu, a me na mauna, a me na mea kiekie a pau.

2. O ke analoa, oia ke ana ana o na wa mawaena o na mea elua e like me ka wa mawaena o na kulanakauhale elua, a me na aina, penei; mai Maui a Lanai.

NO KE ANA ANA.

1. Penei kekahi ana ana. Ma ka manao o ka mea nana e ana, ina paha e hiki ia ia ke hoopili aku i ka laau ana, i ke kaulahao paha, e ana no pela.

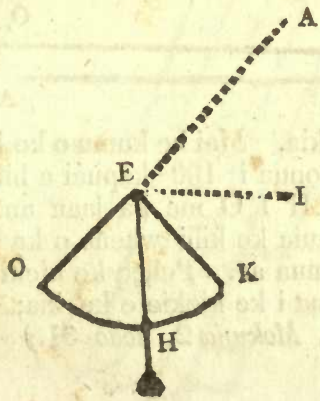
2. Penei kekahi ana ana; ina aole e hiki ke hoopili aku i ka laau ana a me ke kaulahao, alaila, ma ke anahuinakolu e ana'i.

3. E imi mua i na huina me ka laau ana huina, alaila, ma ke anahuinakolu e imi i ke kiekie, a i ka loa paha.

NANEHAI 1.

E imi i ka huina kiekie a me ka huina hohonu me ka laau ana huina.

E kau i ke kiko ma A, oia kahi maluna o ka puu. E imi i ka huina A E I me ka laau ana huina, oia ka huina kiekie o ka puu.

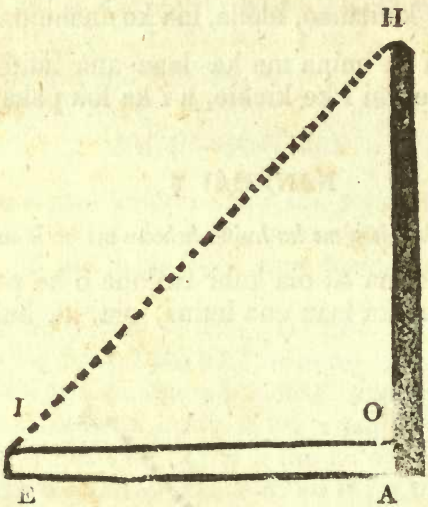


Penei ka imi ana i ka huina; E hoopili i ke kihi waena o ka laau poaihapaha ma ke kihi o ka huina kiekie, a e hoopili i ka maka ma ke kihi o ka poaihapaha ma O, a malaila e nana pololei aku a hiki i A, oia kahi maluna o ka puu. Alaila o ka pio H K i okiia e ke kaula e lewa ana me ke kepau, oia na degere o ka huina kiekie A E I.

I ke ana ana i na huina hohonu, e hoopili i ka maka ma ke kihi waena o ka poaihapaha ma E, a malaila e nana pololei aku i ka mea hohonu. O ka pio O H, oia na degere o ka huina hohonu.

NANEHAI 2.

E ana i ke kiekie o ke kia e kupono ana ma kahi papu.



1. A H oia ke kia. Mai ke kumu o ke kia mai A, e ana pololei aku ma ka honua i 100 kapuai a hiki i E. Alaila e imi i ka huina kiekie H I O me ka laau ana huina, 47 deg. 30 min. oia. Ua kauia ke kihi waena o ka laau ana huina i 5 kapuai mai ka honua ae. Pehea ke kiekie o ke kia?

Penei ka imi ana i ke kiekie o ke kia; *(E nana i ke anahuinakolu kupono, Mokuna 2, aoao 31.)*

Me ka like ana o ka hanai 10.00000
I ka aoaomoe 100 kapuai 2.00000
Pela no ke kahapili o ka huina I 47 deg. 30 min. 10.03794

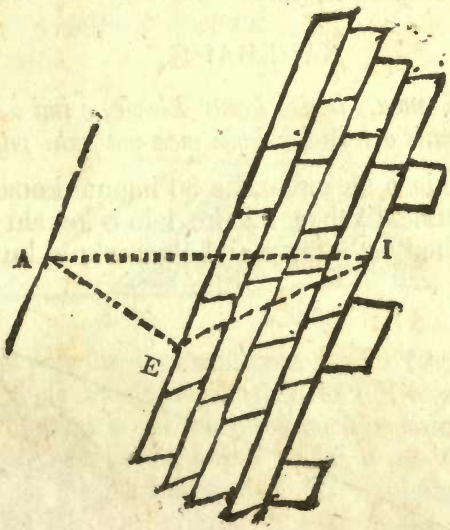
12.03794
10.00000

I ka aoaokupono O H 109.1 kapuai 2.03794
Ka kiekie o ka laau ana A O 5 "

114.1 kapuai, oia ke kiekie o ke kia.

Ina he 45 deg. ka huina I, alaila, ua like ke kiekie o ke kia H A me ka loa o ka aoaomoe A E a me ke kiekie o ka laau ana huina E I, ke hui pu ia laua.

2. Eia ka papu, a me ke awawa i eliia a puni ka pa. He 18 kapuai ke akea o ke awawa. Ma ke kapa o ke awawa, ana aku la au i ka huina kiekie o ka papu, 62 deg. 40 min. oia. Pehea ke kiekie o ka papu? a pehea hoi ka loa o ke alapii e ku ana ke kumu ma keia kapa o ke awawa, a pili ka welau maluna o ka pa?



E imi i ke kiekie o ka papu penei; *(E nana i ke anahuina-kolu aoao* 31.)

Me ka like ana o ka hanai	10.00000
I ka aoaomoe A E 18 kapuai	1.25527
Pela no ke kahapili o ka huina A 62 40	10.28661
	11.54188
	10.00000
I ke kiekie o ka papu E I 34.8 kapuai,	1.54188

E imi i ka loa o ke alapii, (oia ka aoaoloa,) penei;

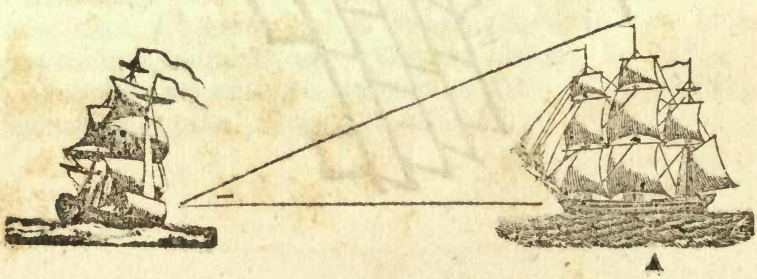
Me ka like ana o ka hanai	10.00000
I ka aoaomoe 18 kapuai	1.25527
Pela no ke kahaoki o ka huina 62 40	10.33302
	11.59329
	10.00000
I ka aoaoloa 39.2 kapuai	1.59329

Nolaila, o ke kiekie o ka papu 34.8 kapuai oia; a o ka loa o ke alapii 39.2 kapuai no ia.

NANEHAI 3.

Maluna o kekahi mea i ikeia kona kiekie, e imi i ka loihi mai kekahi mea a hiki i kekahi mea ma kahi papu.

Maluna o ke kia o ka moku, he 80 kapuai kona kiekie, ana iho la au i ka huina haahaa ma ko lalo o kekahi moku e, 20 deg. no ia. Pehea ka loihi mai ko'u moku e ku ana a hiki i kela moku?



E hoolawe i 20 deg. noloko ae o ke 90, a loaa mai ka huina E 70 deg.

Alaila, penei ka imi ana;

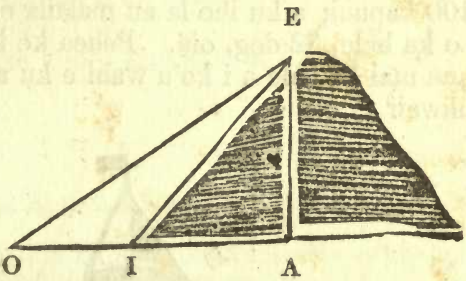
Me ka like ana o ka hanai	10.00000
I ka aoao A E 80 kapuai	1.90309
Pela no ke kahapili o ka huina E 70 deg.	10.43893
	12.34202
	10.00000
I ka aoao I A 219.7 kapuai	2.34202

Nolaila, 219.7 kapuai, oia ka loihi mai kekahi moku a hiki i kekahi moku.

NANEHAI 4.

E imi i ke kiekie o ke kupono ana o kekahi mea, aole hiki ke hele aku a kokoke i kona kumu.

Eia ka puu; a ku iho la au ma kahi papu ma I, e ana i ka huina kiekie o ka puu 46 deg. oia. Alaila haliu aku au malaila aku, e ana ma ka honua i 100 anana; a ku iho la au, malaila e ana hou i ka huinakiekie o ka puu 31 deg. no ia. Pehea ke kiekie kupono o ka puu?



O na huina a pau ma ka huinakolu E O I 180 deg. o lakou ke hui pu ia. Pela no na huina elua O I E a me A I E 180 deg. o laua ke hui pu ia, no ka mea, ua like laua me na huina kupono elua. Nolaila, o na huina I O E a me O E I, ua like laua ke hui pu ia, me ka huina A I E. Nolaila, ina i hoolaweia ka huina O 31 deg. noloko ae o ka huina A I E 46 deg.,

loaa mai ka huina O E I 15 deg. Alaila, e imi i ka aoao I E penei; *(E nana i ke anahuinakolu aoao* 41.)

Me ka like ana o ke koo o ka huina E 15 . . . . . 9.41299
I ka aoao O I 100 anana 2.00000
Pela ke koo o ka huina O 31 deg. 9.71183

11.71183
9.41299

I ka aoao I E 2.29884

Alaila e imi i ka aoao A E, (oia ke kiekie kupono o ka puu,) penei; *(E nana i ke anahuinakolu, aoao* 28.)

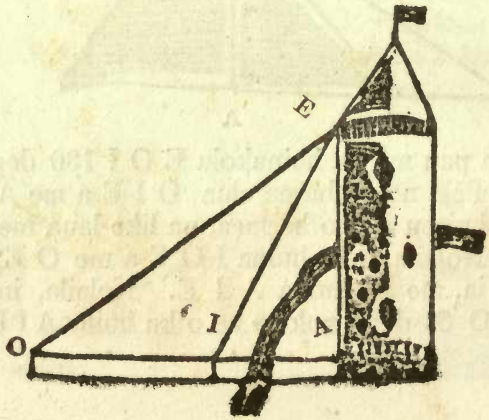
Me ka like ana o ka hanai 10.00000
I ka aoaoloa I E 2.29884
Pela no ke koo o ka huina I 46 deg. 9.85693

12.15577
10.00000

I ka aoaokupono A E 143.1 2.15577

Nolaila, 143.1 anana ke kiekie kupono o ka puu.

2. Eia ka hale e ku ana ma kela kapa o ka muliwai. A ana aku la au i ka huina kiekie o ka hale ma keia kapa o ka muliwai, 58 deg. oia; alaila haliu aku au malaila aku, e ana ma ka honua i 100 kapuai; a ku iho la au malaila e ana hou i ka huina kiekie o ka hale, 32 deg. oia. Pehea ke kiekie o ka hale? a ehia anana mai ka hale a i ko'u wahi e ku ana ma keia kapa o ka muliwai?



E hana e like me ia mamua. E hoolawe i ka huina O 32 deg. noloko ae o ka huina I 58 d g., a loaa mai ka huina E 26 deg. Alaila e imi i ka aoao I E penei;

Me ka like ana o ke koo o ka huina E 26 deg. . .	9.64184
I ka aoao O I 100 kapuai	2.00000
Pela no ke koo o ka huina O 32 deg.	9.72420
	11.72420
	9.64184
I ka aoao I E	2.08236

Alaila e imi i ka aoao A E, (oia ke kiekie o ka hale,) penei;

Me ka like ana o ka hanai	10.00000
I ka aoao loa I E	2.08236
Pela no ke koo o ka huina I 58 deg.	9.92842
	12.01078
	10.00000
I ka aoaokupono A E 102.5	2.01078

O ke kiekie o ka laau ana 5.

107.5

E imi i ka aoao A I penei;

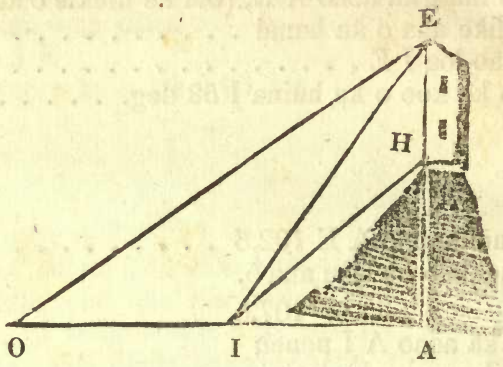
Me ka like ana o ka hanai	10.00000
I ka aoaoloa I E	2.08236
Pela no ke koo o ka huina E 32 deg.	9.72420
	11.80656
	10.00000
I ka aoao A I 64 kapuai	1.80656

Nolaila 107.5 kapuai, oia ke kiekie o ka hale; he 64 kapuai mai ka hale a i ko'u wahi e ku ana.

NANEHAI 5.

E imi i ke kiekie o ka mea e ku ana maluna o kekahi mea, aole hiki ke pii aku a kokoke.

Eia ka hale maluna o ka puu. Ana aku la au i ka huina kiekie o ka puu, 40 deg. oia. Ua ana hoi au i ka huina kiekie o ka hale, 51 deg. oia. Alaila haliu aku au mailaila aku, e ana ma ka honua i 100 kapuai; a ku iho la au malaila e ana hou i ka huina kiekie o ka hale, 33 deg. 45 min. oia. Pehea ke kiekie o ka hale?



E hana e like me ia mamua; e hoolawe i ka huina O 33 deg. 45 min. noloko ae o ka huina A I E 51 deg., a loaa mai ka huina O E I 17 deg. 15 min. Alaila, e imi i ka aoao I E penei;

Me ka like ana o ke koo o ka huina E 17 15 . . . 9.47208
I ka aoao O I 100 anana 2.00000
Pela no ke koo o ka huina O 33 deg. 45 min. . . . 9.74473

11.74473
9.47208

I ka aoao I E 2.27265

E hoolawe i ka huina A I H 40 deg. noloko ae o ke 90

deg., a loaa ka huina I H A 50 deg. O ka huina I H A, a me ka huina E H I, ua like laua ke huipuia me na huinakupono elua 180 deg. Nolaila e hoolawe i ka huina I H A 50 deg. noloko ae o ka 180 deg., a loaa mai ka huina E H I 130 deg. E hoolawe i ka huina A I H noloko ae o ka huina A I E, a loaa mai ka huina E I H 11 deg. Alaila e imi i ka aoao E H penei; (*E nana i ke anahuinakolu aoao* 41.)

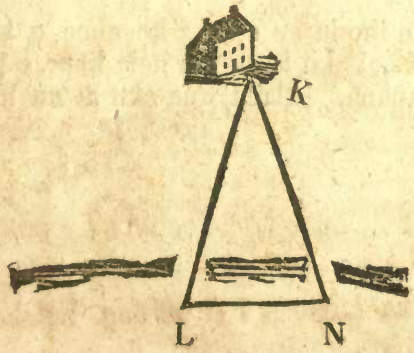
Me ka like ana o ke koo o ka huina E H I 130 . .	9.88425
I ka aoao E I	2.27265
Pela no ke koo o ka huina E I H 11 deg.	9.28059
	11.55324
	9.88425
I ka aoao E H 46.6 anana	1.66899

Nolaila 46.6 anana, oia ke kiekie o ka hale.

NANEHAI 6.

E imi i ka loihi o kekahi mea, mai kekahi wahi aku, aole hiki ke ana me ke kaulahao a me ka laau ana.

1. Eia ka hale ma kela kapa o ka muliwai ma K. Ku iho la au ma keia kapa ma L. Pehea ka loihi mai ko'u wahi i ku ai a hiki i ka hale?



Ana pololei aku la au ma ka loa o ka muliwai i 200 anana mai L a hiki i N. Alaila, ana aku la au me ke panana i ka huina ma L, 73 deg. 15 min. oia. A ana hou aku la au i ka huina ma N, 68 deg. 2 min. oia. A e hoouluulu i ka huina N, 68 deg. 2 min. a me ka huina L 73 deg. 15 min., a loaa mai 141 deg. 17 min.; a e hoolawe ia mau degere noloko ae o ka 180, a loaa mai 38 deg. 43 min., oia ka huina ma ka hale. Alaila e imi i ka aoao K N, (oia ka loihi mai ko'u wahi i ku ai a hiki i ka hale,) penei;

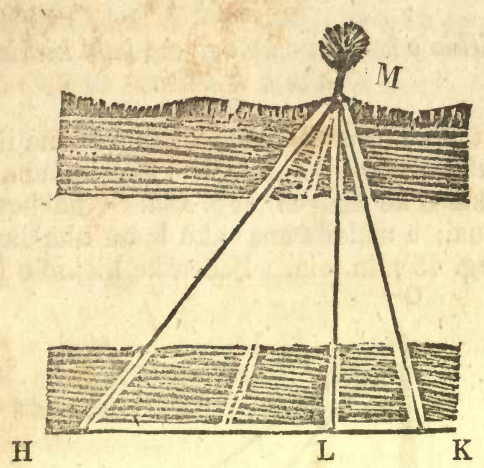
Me ka like ana o ke koo o ka huina K 38 43 . . .	9.79620
I ka aoao L N 200 anana	2.30103
Pela no ke koo o ka huina L 73 15	9.98117
	12.28220
	9.79620
I ka aoao N K 306.19 anana	2.48600

E imi i ka aoao L K penei;

Me ka like ana o ke koo o ka huina K 38 43 . . .	9.79620
I ka aoao L N 200 anana	2.30103
Pela no ke koo o ka huina N 68 02	9.96726
	12.26829
	9.79620
I ka aoao L K 296.54 anana	2.47209

2. Makemake iho la au e ike i ke akea o kekahi muliwai, nolaila, ana pololei aku la au ma keia kapa o ka muliwai mai H a i K i 100 anana. Alaila, ana aku la au me ke panana i

ka huina K H M 53 deg. oia. Pela no ka huina Ma K, 79 deg. 12 min. oia. Pehea ke akea kupono o ka muliwai mai L a i M.



E hoouluulu i ka huina H 53 a me ka huina K 79 deg. 12 min., a loaa mai 132 deg. 12 min.; a hoolawe i 132 deg. 12 min. noloko ae o ka 180 deg., a loaa mai ka huina H M K, 47 deg. 48 min. oia.

E imi i ka aoao H M penei;

Me ka like ana o ke koo o ka huina 47 48	9.86970
I ka aoao H K 100 anana	2.00000
Pela no ke koo o ka huina K 76 12	9.99223
	11.99223
	9.86970
I ka aoao H M	2.12253

E imi i ka aoao L M penei.

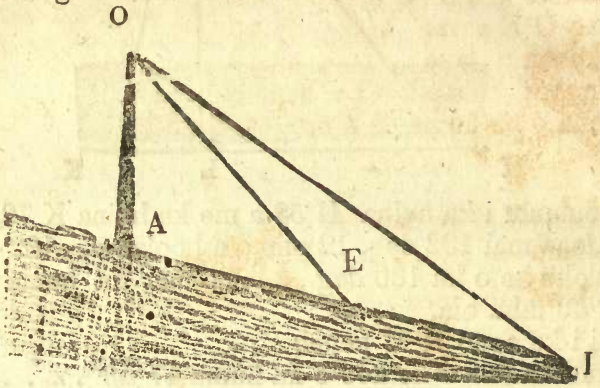
Me ka like ana o ka hanai	10.00000
I ka aoao H M	2.12253
Pela no ke koo o ka huina H 53 deg.	9.90234
	12.02487
	10.00000
I ka aoao L M 105.9	2.02487

Nolaila 105.9 anana, oia ke akea kupono o ka muliwai.

NANEHAI 7.

E imi i ke kiekie o ka mea e ku ana ma kahi kiekie, e hiki ke pii aku a kokoke.

Eia ke kia e ku ana ma kahi kiekie. Ana iho la au mai kona kumu aku a hiki i 40 kapuai. Malaila ana aku la au i ka huina kiekie o ke kia, 41 deg. oia. Ana hou au malaila aku i 60 kapuai; a malaila ana aku la au i ka huina kiekie o ke kia, 23 deg. 45 min. oia. Pehea ke kiekie o ke kia?



O na huina akolu o ka huinakolu O E I ke hui pu ia, 180 deg. oia. Pela hoi ka huina I E O a me ka huina A E O ke hui pu ia, 180 deg. oia. Nolaila, o ka huina A E O, ua like ia me na huina ma O a me I ke hui pu ia; nolaila hoi, e hoolawe i ka huina I 23 deg. 45 min. noloko ae o ka huina A E O 41 deg. a koe mai ka huina E O I 17 deg. 15 min.

Alaila, penei ka imi ana o ka aoao O E;

Me ka like ana o ke koo o ka huina O 17 15 . .	9.47208
I ka aoao E I 60 kapuai	1.77815
Pela no ke koo o ka huina I 23 45	9.60502
	11.38317
	9.47208
I ka aoao O E 81.48 kapuai	1.91109

Alaila, penei ka imi ana i ka huina A O E; *(E nana i ka anahuinakoluhio, Mokuna 3, aoao 44.)*

E houluulu i ka aoao O E 81.48, a me ka aoao E A 40, a loaa mai 121.48. E hoolawe i ka aoao E A 40 kapuai noloko ae o ka aoao O E 81.48, a koe mai 41.48.

E hoolawe i ka huina E 41 deg. noloko ae o ka 180 deg. a koe mai 139 deg. oia ka hui pu ana o na huina o A a me O. E imi i ka hapalua o kela mau huina, 69 deg. 30 min. no ia. Alaila, e imi i ka huina A O E penei;

Me ka like ana o ka hui pu ana o na aoao O E a me A E 121.48	2.03453
I ke koena o laua 41.48	1.61792
Pela no ke kahapili o ka hapalua o ka hui pu ana o na huina A a me O 69 30	10.42726
	12.04518
	2.08453
I ke kahapili o ka hapalua o ke koena o laua 42 24	9.96065

E hoolawe i ka mea i loaa mai 42 24 noloko mai o ka hapalua o ka hui pu ana o na huina O a me A 69 30, a loaa mai ka huina O 27 deg. 6 min.

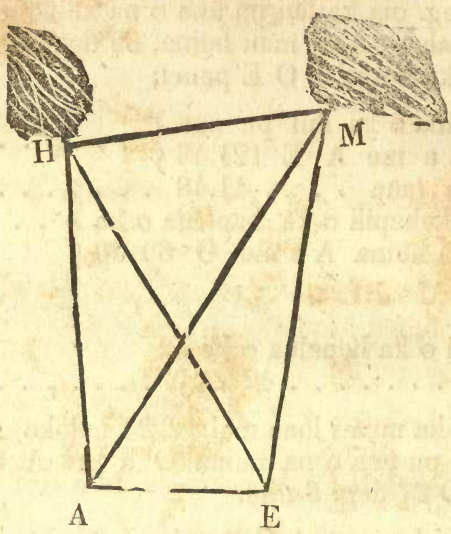
Alaila, e imi i ka aoao A O penei;

Me ka like ana o ke koo o ka huina O 27 6 . . .	9.65828
I ka aoao A E 40 kapuai	1.60206
Pela ke koo o ka huina E 41 deg.	9.81694
	11.41900
	9.65828
I ka aoao A O 57.62 kapuai	1.76072

NANEHAI 8.

E imi i ka wa mawaena o na mea elua, aole hiki ke hookokoke aku.

Eia na aina elua me Molokai a me Lanai; heaha ka wa mawaena o laua?



Eia no au ma Maui, aole hiki ke hookokoke aku a e ana me ke kaulahao; nolaila, e ana au ma kahi pololei ma Maui mai A a hiki i E i 300 kaulahao. Me ke panana, e ana au i ka huina M A E 58 deg. 20 min., a me ka huina H A M 37 deg., a me ka huina A E H 53 deg. 30 min., a me ka huina H E M 45 deg. 15 min.

E hoouluulu i ka huina A E H a me M E H a loaa mai ka huina A E M 98 deg. 45 min. E hoouluulu i ka huina A E M 98 45 me ka huina E A M 58 20, a loaa mai 157 05. E hoolawe i 157 05 noloko ae o na degere 180 a loaa 22 55, oia ka huina E M A. Pela no e houluulu i ka huina H A M a me M A E a me A E H, a e hoolawe i ka mea i loaa mai noloko ae o ka 180, a loaa mai i ka huina A H E 31 deg. 10 min.; alaila, e imi i ka aoao A H penei;

Me ka like ana o ke koo o ka huina H 31 10 . . . 9.71393
I ka aoao A E 300 . . . . . 2.47712
Pela no ke koo o ka huina A E H 63 30 . . . . . 9.90517

12.38229
9.71393

I ka aoao A H 465.9 . . . . . 2.66836

E imi i ka aoao A M penei;
Me ka like ana o ka huina M 22 55 . . . . . 9.59038
I ka aoao A E 300 . . . . . 2.47712
Pela no ka huina A E M 98 45 . . . . . 9.99491

12.47203
9.59038

I ka aoao A M 761.4 . . . . . 2.88165

E imi i ka huina A M H penei; *(E nana i ke anahuinakoluhio Mokuna 3, aoao 44.)*

E houluulu i ka aoao A H 465.9 me ka aoao A M 761.4, a loaa mai 1227.3. E hoolawe i ka aoao A H 465.9 noloko mai o ka aoao A M 761.4, a koe mai 295.5.

E hoolawe i ka huina H A M 37 deg. noloko mai o ka 180, a koe mai 143, oia ka hui pu ana o na huina A H M a me A M H. O ka hapalua o kela mau huina, 71 deg. 30 min. no ia. Alaila, penei ka like ana;

Me ka like ana o ka hui pu ana o na aoao A H a me A M . . . . . 1227.3 } 3.08900
I ke koena o laua . . . . . 295.5 . . . . . 2.47053
Pela no ke kahapili o ka hapalua o ka huipu ana o na huina A H M a me A M H 71 30 } . 10.47548

12.94601
3.08900

I ke kahapili o ka hapalua o ke koena o laua 35 44 . 9.85701

E hoolawe i ka mea i loaa mai 35 deg. 44 min. noloko o ke 71 deg. 30 min. a loaa mai 35 deg. 46 min., oia ka huina A M H.

Alaila, e imi i ka aoao H M penei;

Me ka like ana o ka huina A M H 35 46	9.76677
I ka aoao A H 465.9	2.66836
Pela no ka huina H A M 37	9.77946
	12.44782
	9.76677
I ka aoao H M 479.8	2.68105

Nolaila, 479.8 kaulahao, oia ka wa mawaena o kela mau aina elua.

Penei kekahi ana ana o ke kiekie o ka mea kupono; e ana i ke aka o ka mea kupono. E ana hoi i ka loa o kekahi laau a me ka loa o kona aka; alaila, penei ka like ana;

Me ka like ana o ke aka o ka laau,
I ka loa o ka laau;

Pela ka like ana o ke aka o ka mea kupono,
I kona kiekie.

E hoonui i ke aka o ka mea kupono me ka loa o ka laau; a e puunaue i ka mea i loaa mai me ke aka o ka laau, a loaa mai ke kiekie o ka mea kupono. *(E nana i ka Helunaau, aoao* 91, *pauku* 1. *Na ui hoiliili.)*

KE ANAAINA.

Oia ka mea e hoike mai i ke ana a me ka mahele aina. Eia kekahi mau mea hoakaka:—

1. Ka Akere: oia ke ana nui no ka aina: he ana no ka ili wale no ka Akere, he loa, a he laula, aole nae he manoanoa.

2. Ke Kaulahao: oia ka mea e ana i na aoao o na aina: eha roda kona loa, oia hoi 66 kapuai: a ua maheleia ke kaulahao i 100 hapa like: ua kapaia hoi ua poe hapa la, he mau pauku. 7 iniha a me 9-2 hapahaneri ka loa o ka pauku hookahi.

Ina he aina uuku, apuupuu paha ka aina e anaia ai, alaila, ke kaulahao roda 2 ka pono, oia 33 kapuai.

He ana no na mea ili:—

144	iniha huinahalike	1	kapuai huinahalike ia.
9	kapuai huinahalike	1	iwilei huinahalike ia.
36	kapuai huinahalike	1	anana huinahalike ia.
121	anana huinahalike	1	kaulahao huinahalike ia.
1	kaulahao huinahalike	16	roda huinahalike ia.
40	roda huinahalike	1	ruda huinahalike ia.
4	ruda, oia 10 kaulahao	1	akere.
100	kaulahao huinahalike	1	setadia huinahalike ia.
64	setadia huinahalike	1	mile huinahalike ia.

MOKUNA 1.

He mau Nanehai.

1. E hoolilo i na kaulahao elua roda ka loa i na kaulahao eha roda ka loa.

Penei e hana'i: e imi i ka hapalua o na kaulahao roda 2, a e houluulu i na pauku; penei, 16 kaulahao roda 2 a me 37 pauku, ua like ia me 8 kaulahao roda 4, a me 37 pauku.

Aka, ina he mau huahelu hiki ole ke mahele koena ole, alaila, e puunaue i 2 a e houluulu i 50 me na pauku: penei, 17 kaulahao roda 2 a me 42 pauku, ua like ia me 8 kaulahao roda 4 a me 92 pauku.

2. E hoolilo i na kaulahao roda 2 i mau roda a me na hakina hapaumi o ka roda.

Penei e hana'i: e hoonui i na kaulahao roda 2 me 2 a e hoonui hoi i na pauku me 4 e like me keia, 17 kaulahao roda 2 a me 21 pauku, e hoonui i ka 17 kaulahao roda 2 me 2 a loaa mai 34 roda, a e hoonui i ka 21 pauku me 4, a loaa mai 84 hapahaneri, 34.84.

3. E hoolilo i na kaulahao roda 4 i mau roda.

E hoonui me ka 4 penei: 8 kaulahao a me 64 pauku ua like ia me 34.56 roda.

4. E hoolilo i na roda i na akere.

Penei: iloko o ka akere hookahi 160 roda huinahalike. Nolaila, e puunaue i na roda me 160, e loaa mai na akere, a ina he koena, e puunaue no ia me 40, i loaa'i na ruda.

5. E hoolilo i na kaulahao huinahalike i na akere.

Penei: e puunaue me ka 10, e like me keia 1460 kaulahao huinahalike, ua like ia me 146 akere, a 846 kaulahao huinahalike, ua like ia me 84 akere a me 6 hapaumi 84.6. Iloko o na roda 746 ehia akere a me na ruda a me na roda.

6. E hoolilo i na pauku huinahalike i na akere.

Penei e hana'i: e puunaue me 100,000, oia ka hookaawale i na huahelu 5 ma ka akau: a ina he koena e hoonui ia me 4, a e hookaawale i na huahelu elima ma ka lima akau: a ina he koena iho e hoonui ia me 40 a e hookaawale i elima huahelu hou ma ka lima akau. Penei:

15)63274
4

2)53096
40

21)23840

15 akere 2 ruda 21 roda

Eia kekahi: e hoonui i ka aoao moe me ka hapalua o ka aoao kupono.

Eia ka lua: e hoonui i ka aoao kupono me ka hapalua o ka aoao moe.

Eia ke kolu: e hoonui i ka aoao moe me ka aoao kupono, a o ka hapalua o ka mea i loaa mai, oia no ka ili.

4. E imi i ka ili o ka aina huinakoluhio.

(E nana i ke kii 5.)

E hookuu ilalo i kaha kupono mai kekahi huina a i kona aoao ku e: alaila, e imi i ka loa o ua aoao kupono la ma ke Anahuinakolu. (E nana i ka Anahuinakoluhio, mokuna 4.) Alaila, e hana aku e like me ka Nanehai 3 iho nei: a loaa mai ka ili o ka huinakolu AOI, a me EOI, a e houluulu pu ia laua, oia ka ili o ka huinakoluhio AEI.

5. Ina paha i hoikeia mai na aoao ekolu o ka huinakolu, ma ka huahelu wale no e loaa'i ka ili.

[Eia kekahi mea haule ma ke Anaaina aoao 67.]

E imi i ka ili o ka huinakolu.

Ina i hoikeia mai na aoao elua a me ka huina mawaena o laua, penei ka imi ana o ka ili; E houluulu i ka Huhuihelu o ua mau aoao la elua a me ke koo o ka huina mawaena, a e hoolawe i ka Hanai; o ka mea koe, oia ka Huhuihelu o ka palua o ka ili; a e puunaue ia i ka lua a loaa no ka ili.

Penei;

Aoao, 105	2.02119
Aoao, 85	1.92942
Koo o ka huina 23° 5′	9.67280
	13.62341
Hanai hoolawe	10.00000
Palua o ka ili 4200	3.62341

Ka hapalua 2100 Roda, oia ka ili.

huinahalike, ua like ia me 84 akere a me 6 hapaumi 84.6. Iloko o na roda 746 ehia akere a me na ruda a me na roda.

6. E hoolilo i na pauku huinahalike i na akere.

Penei e hana'i: e puunaue me 100,000, oia ka hookaawale i na huahelu 5 ma ka akau: a ina he koena e hoonui ia me 4, a e hookaawale i na huahelu elima ma ka lima akau: a ina he koena iho e hoonui ia me 40 a e hookaawale i elima huahelu hou ma ka lima akau. Penei:

15)63274
4

2)53096
40

21)23840

15 akere 2 ruda 21 roda

MOKUNA 2.

He mau Nanehai no ke Anaaina.

1. E imi i ka ili o ka aina huinahalike a me ka aina huinahaloa. (E nana i na kii 1, 2.)

E hoonui ka loa a me ka laula. Penei:

6 ka laula.	6 ka loa.
6 ka loa.	3 ka laula.
—	—
36 ka ili.	18 ka ili.

2. E imi i ka ili o ka aina huinahahio a me ka aina huinahahio loihi.

E hookuu ilalo i kaha kupono mai kekahi huina a i ka aoao i ku e ana, alaila, e hoonui i ua aoao la me ua kaha ku pono la. Penei: (E nana i na kii 3, 4.)

AE	6	KL	20
IO	4	MN	5
	—		—
	24 ka ili.		100 ka ili.

3. E imi i ka ili o ka aina huinakolu kupono.

Eia kekahi: e hoonui i ka aoao moe me ka hapalua o ka aoao kupono.

Eia ka lua: e hoonui i ka aoao kupono me ka hapalua o ka aoao moe.

Eia ke kolu: e hoonui i ka aoao moe me ka aoao kupono, a o ka hapalua o ka mea i loaa mai, oia no ka ili.

4. E imi i ka ili o ka aina huinakoluhio.

(E nana i ke kii 5.)

E hookuu ilalo i kaha kupono mai kekahi huina a i kona aoao ku e: alaila, e imi i ka loa o ua aoao kupono la ma ke Anahuinakolu. (E nana i ka Anahuinakoluhio, mokuna 4.) Alaila, e hana aku e like me ka Nanehai 3 iho nei: a loaa mai ka ili o ka huinakolu AOI, a me EOI, a e houluulu pu ia laua, oia ka ili o ka huinakoluhio AEI.

5. Ina paha i hoikeia mai na aoao ekolu o ka huinakolu, ma ka huahelu wale no e loaa'i ka ili.

Penei: e houluulu pu i na aoao ekolu; a mai ka hapalua mai o keia akoakoa ana e hoolawe i kela aoao i keia aoao o ka huinakolu: e kakau okoa i na koena akolu: alaila, e hoonui pu i ua hapalua nei me kekahi koena: e hoonui iho i ka mea i loaa mai me kekahi koena, a e hoonui hou iho i keia mea i loaa mai me ke kolu o na koena: alaila, e unuhi i ke *kumu ili* o ka mea i loaa hope mai. Penei:

(E nana i ke kii 6.)

18 }
20 } na aoao.
24 }

2)62

31 hapalua o na aoao i huipuia.
18 kekahi aoao.

13 koena 1.

31
24

7 koena 2.

31
20

11 koena 3.

31
13

93
31

403
11

403
403

4433
7

3,103,1 (176.1 [mu ili.
1

27)210
189

346)2131
2076

3521)55.00
3521

6. Ma ka Huhuihelu e imi ai i ka ili o ua huinakolu nei. Penei:

Ka hapalua o na aoao i huipuia 31, 1.49136
Ke koena 13, ... 1.11394
Ke koena lua 7, ... 0.84510
Ke koena kolu 11, ... 1.04139

2)4.49179

Ka ili 176 . . . 2.24589

7. E imi i ka ili o ka aina huinahalualike. (E nana i ke kii 7.)

E kaha mua i kaha kupono mai kekahi o na kaulike a i kekahi, e like me EK, alaila, e houluulu pu i na aoao kaulike elua a e hoonui i ka hapalua o ia mau aoao, me ke kaha kupono. Penei:

AE . . 10
OI . . 15

2)25

12.5
5 EK.

62.5 ka ili.

8. E imi i ka ili o ka aina huinahalikeole.

(E nana i ke kii 8)

Ua ikeia na aoao a pau, e imiia ai ka ili oloko.

E kaha mua i *kaha kapakahi* e like me AE: mai na huina I a me K, e hookuu i mau kaha kupono elua a i ke kaha kapakahi AE, e like me In, KL, alaila, e imi i ka ili o na huinakolu AIn, ILE, EKL, KLA, (e like me Nanehai 3,) a e hui pu i ko lakou ili a pau, o ka ili no ia;— a i ole pela e houluulu pu i na kaha kupono elua (In, KL) a e hoonuiia me ka hapalua o ke kaha kapakahi AE.

9. E imi i ka ili o ka aina huinalehulehu, ua hoikeia mai ai na aoao a pau, e loaa mai ka ili. (E nana i ke kii 9.)

E mahele i ka aina i na huinakolu a me na *huinahalike-*

ole paha, (aia i ke ano o ka aina,) e like me maluna: alaila, e imi i ka ili o na huinakolu a pau, a me na huinahalikeole, (e nana i ka Nanehai 4 a me 8,) a e hui pu i keia mau ili a pau; o ka ili no ia o ka huinalehulehu.

10. No na poai.

1. Ua hoikeia mai ka loa o ka anawaena e loaa mai ke anapuni. Penei e hana'i:

Me ka like ana o 7 i 22, pela hoi ke anawaena i ke anapuni. (E nana i ke kii 10.)

7 : 22 : : 10

10

7)220

31.4 ke anapuni.

2. Ua hoikeia mai ka loa o ke anapuni i loaa mai ke anawaena. Penei:

Me ka like ana o 22 i 7, pela hoi ke anapuni i ke anawaena.

22 : 7 : : 20 ke anapuni.

7

22)140(6.36 ke anawaena

132

80

66

140

132

8

3. Ua hoikeia mai ke anapuni a me ke anawaena e loaa mai ka ili. Penei:

E hoonui i ka hapalua o ke anapuni me ka hapalua o ke anawaena; o ka ili no ia.

4. Ua hoikeia mai ke anawaena wale no e loaa mai ka ili. Penei:

E hoonui i ke anawaena me ke anawaena, a e hoonui hou iho i ka mea i loaa mai me 0.7854; o ka ili no ia.

10 ke anawaena
10 " "

100
0.7854

78,5400 ka ili.

5. Ua hoikeia mai ke anapuni wale no e loaa mai ka ili. Penei:

E hoonui i ke anapuni me ke anapuni, a e hoonui hou iho i ka mea i loaa mai me 0.07958; o ka ili no ia.

20 ke anapuni
20 " "

400
0.07958

31.83200 ka ili.

6. Ua hoikeia mai ka ili o ka poai e loaa mai ke anawaena. Penei:

E puunaue i ka ili me 0.7854 a e unuhi mai i ke *kumu ili* o ka mea i loaa mai.

7854)5000.0(.06366
47124

28760
23562

51980
47126

48560
47124

.0.63.66(079
0

7163
49

149)1466
1341

7. Ua hoikeia mai ka ili i loaa mai ke anapuni. Penei: E puunaue i ka ili me 0.07958, a e unuhi mai i ke *kumu ili* o ka mea i loaa mai.

MOKUNA 3.

No ke Kaapuni Aina.

O ke kaapuni, oia ke ana ana i na aoao a pau a me na huina o ka aina me ke kaulahao a me ka panana.

1. No ke kaapuni ana i ka ainahuinakolu.

E ana i na aoao a pau me ke kaulahao, a e kakau okoa ma ka pepa i kela aoao a i keia aoao. E kakau i *hoohalikeaina*; alaila, e imi i ka ili e like me ka Nanehai 5, Mok. 2, a i ole ia, e like me ka Nanehai 4, Mok. 2.

(E nana i ke kii 11.)

EI . . . 24 kaulahao.
½ AO . . . 7.34 "

2936
1468

17) 6.16
4

2) 4.64
40

18) 5.60
17 akere 2 ruda 18 roda

2. No ke kaapuni ana i ka aina huinahalikeole.

(E nana i ke kii 12.)

E ana i na aoao a pau a e ana hoi i *kaha kapakahi* mai kekahi huina a i ka huina ku e, me EO, alaila, e imi i ka ili e like me ka Nanehai 8, Mok. 2.

O ke kaha ana i ka huinahalikeole.

E kaha mua ma ka pepa i ka aoao EU, 27.50 K. E

lawe me ka upa i ka aoao OU 11.70 K, a e kaha i ka pio ma O. Pela hoi e lawe me ka upa i ke kaha kapakahi EO 28. K. E kau i kekahi wawae ma E a e kaha aku i pio e oki ana i kela pio ma O; oia kekahi kihi o ka aina. Pela no hoi e hana'i me EA a me OA i loaa mai ke kihi ma A; alaila, e kaha aku i na aoao UO, AO, EA.

O ka imi ana i ka ili.

Me ka upa a me ka rula e ana i na kaha kupono UK (11.34) a me Ah, (11.10.) E houluulu pu ia laua a e hoonui i ke akoakoa ana me ka ½ o ke kaha kapakahi EO. (E nana i ka Nanehai 8, Mok. 2.) Penei:

11.34 . . . UK
11.10 . . . AH

22.44
14.00 ½ o EO

89.7600
224.4

31)41600 pauku ili.
4

1)66400
40

26)56 000
31 akere 1 ruda 26 roda

3. E kaapuni i ka aina huinalehulehu me ke kaulahao wale no. E nana i ke kii 13.

E ana pono i na aoao a pau o ka aina a e kakau i na mea i loaa mai ma ka pepa. E imi i ke kihi, kahi i ikea'i na kihi e ae a pau o ua aina nei. E ana i mau kaha kapakahi mai ua kihi la a i kela kihi keia kihi o ka aina. E kakau i hoohalikeaina ma ka pepa a e imi i ka ili e like me ka Nanehai 9, Mok. 2.

Eia iho na aoao i anaia.

	K p	
AL	30.60	Aia ma A, ke kihi, kahi i ikea'i na kihi e ae a pau.
LK	20.40	
KO	22.40	Eia malalo iho nei na kaha kapakahi mai A, a i na kihi K, O, I.
OI	16.20	*H*
IE	13.50	A K 45
IE	13.50	A O 35
EA	28	A I 24.20

Penei e kakau iho ai i ka hoohalikeaina. E kaha mua i ka aoao moe AL, 30 kaulahao a me 60 pauku, e lawe me ka upa a me ka rula i ke kaha kapakahi AK, 45 kaulahao; e kau i kekahi wawae ma A a e kaha i ka pio ma K. Pela hoi e lawe i ka aoao LK e kau i kekahi wawae ma L, a e kaha i ka pio e oki ana i kela pio ma K, oia kekahi kihi o ka aina. Pela no e hana'i me AO, a me KO, me AI, a me OI; alaila, e kaha aku i na aoao LK, KO, OI, IE, EA, a paa.

E imi i ka ili; penei:

E kaha i mau kaha kupono mai L a i KA, (Ln), a mai O a i KA (oh,) mai I a i OA (Iu) a mai I a i AE (I m.) Alaila e manao ia ALKO he aina huinahalikeole ia, a e imi i ka ili e like me ka Nanehai 8, Mok. 2.

He mau huinakolu AOI a me AEI, e imi i ko laua ili e like me Nanehai 3 paha 4 paha, Mok. 2, a e hui pu i ka mea i loaa mai me ka ili o ALKO, o ka ili no ia.

Ln . . .	11.68	Ka huinakolu AOI.
Oh . . .	17.10	½ IU . . 4.90
		AO . . 35
	28.78	24.50
½ AK .	22.50	147.0
	143900	
	5756	Ka ili o AOI 171.50 kaulahao ili.
	5756	

647.5500 na kaulahao ili o ALKO.

E houluulu Ka huinakolu AEO.

E hana i ka hoohalikeaina. Penei no e hana'i:
E kaha ma ka pepa i kaha pololei mai ke Akau a i ka Hema, a ma ke poo o ua kaha la maluna e kakau i A, (he hoailona ia no ke Akau,) a ma ke poo malalo e kakau i He. (no ka Hema,) ma ka lima akau e kakau i Hi. (Hikina,) a ma ka lima hema e kakau i K. (Komohana.) O

Eia iho na aoao i anaia.

[Eia kekahi mea haule ma ka aoao 75.]

Ma ka moe ana o na aoao o ka aina e imi i na huina mawaena, penei;

1. Ina e moe kekahi aoao i ka Akau a o kekahi aoao i ka Hema, a moe hoi kekahi aoao i ka Hikina, a o kekahi aoao i ke komohana, e hoolawe i ka mea uuku noloko ae o ka mea nui, o ke koena oia ka huina mawaena o laua.

2. Ina e moe kekahi aoao i ka Akau, a o kekahi i ka Hema, a moe laua elua i ka Hikina paha, i ke komohana paha laua elua, e houluulu ka moe ana o laua, a loaa mai no ka huina mawaena.

3. Ina e moe na aoao elua i ka Akau paha, i ka Hema paha, a moe kekahi i ka Hikina a o kekahi i ke Komohana, e hoolawe i ka houluulu ana o laua noloko ae o 180°; o ke koena, oia ka huina mawaena o laua.

4. Ina e moe na aoao elua i ka Akau paha, i ka Hema paha, a moe hoi laua elua i ka Hikina paha, i ke Komohana paha; e hoolawe i ka mea nui o ka moe ana noloko ae o 90° a houluulu i keia koena a me ka mea uuku o ka moe ana me 90°, a o ka mea i loaa, oia ka huina mawaena o laua.

143900
5756 Ka ili o AOI 171.50 kaulahao ili.
5756

647.5500 na kaulahao ili o ALKO.

E houluulu

ALKO . . 647.55
AOI . . 171.50
AEI . . 163.10

98)2.15
4

860
40

34)400

Ka huinakolu AEO.

Kaha kupono Em 11.65
½ AE 14

4660
1165

Kaulahao ili iloko AEO 163,10

98 akere 0 ruda 34 roda

Eia kekahi mea e loaa'i ka ili o keia aina.

E imi i na ili o na huinakolu a pau e like me Nanehai 5, Mok. 2; alaila, e houluulu pu i ua mau ili la a pau. O ka pono loa paha keia.

4. E kaapuni i kekahi aina me ke kaulahao a me ka panana. E nana i ke kii 14.

E ana i na aoao a pau me ke kaulahao a e imi i ka *moe ana* o kela aoao, a keia aoao me ka panana. E kakau iho i na mea i loaa mai ma ka pepa; alaila, e kakau i hoohalikeaina, a e imi i ka ili e like me ka mea i hanaia iho nei.

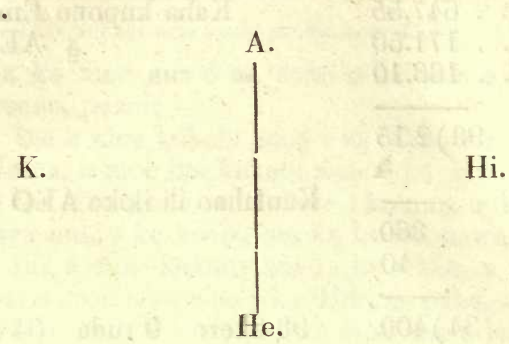
Eia malalo iho nei na mea i loaa mai me ke kaulahao a me ka panana.

		K. p.
A. 7°	K.	28.20
A. 74°	Hi.	39.50
He. 9°	Hi.	33.
A. 63° 20 min.	K.	14.55
He. 74°	K.	28.60

E hana i ka hoohalikeaina. Penei no e hana'i:

E kaha ma ka pepa i kaha pololei mai ke Akau a i ka Hema, a ma ke poo o ua kaha la maluna e kakau i A, (he hoailona ia no ke Akau,) a ma ke poo malalo e kakau i He. (no ka Hema,) ma ka lima akau e kakau i Hi. (Hikina,) a ma ka lima hema e kakau i K. (Komohana.) O

ua kaha la mai ke akau a i ka hema, ua kapaia he Meridiana.



E lawe i kiko ma ua meridiana nei, a e kau hoi i ka poaihapalua me ka aoao pololei e pili ana ia ia, a me ke kikowaena e ku pono ana i ua kiko la. E imi i ka moe ana o ka aoao mua ma na degere o ka poaihapalua a e kiko me ka upa i ua degere la. E kaha aku i kaha pololei, mai ke kiko waena a ilaila a e ana i ka loa o ka aoao mua ma ua kaha nei me ka upa a me ka rula kaha kaulike.

Ma ke kiko i loaa hope mai e kaha i *kahakaulike* i ka meridiana mua, e kau iho i ka poaihapalua a e imi i ka *moe ana* a me ka loa o ka aoao lua e like me ka mua. A pela aku no a puni ka aina.

E imi i ka ili o ua aina nei. Penei:

Mai ke kihi ma O e kaha i mau kaha kapakahi a i A a me E; alaila, e imi i na ili o na huinakolu AUO, AOE, EOI, a e houluulu i ua mau ili la; o ka ili no ia o ka aina AUOIE.

Aole pono loa e ana i ka loa o AO, a me EO, me ka rula kaha kaulike a me ka upa. E imi ma ke Anahuinakolu-hio, oia ka pololei loa.

Ua hoikeia mai na aoao AU a me OU, a me ka huina ma U, a e hiki no ke loaa mai ka aoao AO ma ke Anahuinakolu, alaila, e loaa mai ai ka ili o AUO. Pela no hoi e loaa mai ai ka ili o AOE a me EOI.

5. Eia ilalo nei ka loa a me ka moe ana o na aoao o kekahi aina.

		deg. min.		K. p.
Aoao 1	A.	56.15	Hi.	21.60
" 2	A.	26.30	Hi.	13.44
" 3	He.	71.30	Hi.	18.96
" 4	He.	26.30	Hi.	13.44
" 5	He.	71.30	K.	18.96
" 6	He.	45. 0	Hi.	8.47
" 7	He.	63.30	Hi.	13.44
" 8	A.	45	Hi.	8.47
" 9	He.	26.30	Hi.	13.44
" 10	He.	45	K.	8.47
" 11	He.	63.30	K.	13.44
" 12	A.	76. 0	K.	24.73
" 13	A.	36.45	K.	30

E imi i ka ili e like me ka mea i hanaia iho nei.

Eia no nae ka ili o ia aina. 167 akere 1 ruda 30 roda.

Eia kekahi mea e maopopo ai ka pololei o ke kaapuni ana i kekahi aina.

E imi mua i na degere o na huina a pau o ka aina, a e houluulu pu. E hui pu me ka mea i loaa mai i 360 deg. a e puunaue ia me 180 deg.; alaila, ina he pololei ke kaapuni ana, ina ua like ka mea i loaa mai me ka nui o na huina o ka aina. Ina he 10 na huina o ka aina, he 10 no ka mea i loaa mai, alaila, ua pono ke kaapuni ana, aka, ina aole like, alaila, ua hewa ka hana ana.

Eia ilalao nei ka moe ana a me ka loa o na aoao o kekahi mau aina i loaa mai me ke kaulahao a me ka panana.

Ka aina mua.

		deg. min.		Roda.
Aoao 1	A.	15. 0	He.	320
" 2	A.	37.30	Hi.	160
" 3	Hi.			120
" 4	He.	11. 0	Hi.	200
" 5	He.			216
" 6	K.			160
" 7	He.	36.30	K.	160
" 8	A.	38.15	K.	136

Ka ili, 744 akere 3 ruda 28 roda

Ka aina alua.

		deg. min.		Roda.
Aoao 1	He.	65.40	K.	49.7
" 2	He.	67.15	K.	34.5
" 3	He.	54. 0	K.	17.9
" 4	He.	20. 0	K.	5.8
" 5	He.	7.30	Hi.	29.4
" 6	A.	83. 0	Hi.	107.4
" 7	A.	5.50	K.	22.
" 8	A.	18.30	K.	46.

Ka ili, 34 akere 1 ruda 19 roda

O ka aina akolu.

		deg. min.		K. p.
Aoao 1	A.	75. 0	Hi.	13.70
" 2	A.	20.30	Hi.	10.30
" 3	Hi.			16.20
" 4	He.	33.30	K.	35.30
" 5	He.	76. 0	K.	16.
" 6	A.			9.
" 7	He.	84. 0	K.	11.60
" 8	A.	53.15	K.	11.60
" 9	A.	36.45	Hi.	19.20
" 10	A.	22.30	Hi.	14.
" 11	He.	76.45	Hi.	12.
" 12	He.	15. 0	K.	10.85
" 13	He.	16.45	K.	10.12

Ka ili, 110 akere 2 ruda 23 roda

O ka aina aha.

		deg. min.		Ro. p.
Aoao 1	A.	43. 0	K.	12.44
" 2	A.	64. 0	K.	8.
" 3	A.	52. 0	K.	14.60
" 4	A.	37. 5	K.	51.36
" 5	A.	15.30	K.	21.76
" 6	A.	20.40	K.	44.60
" 7	A.	88.20	Hi.	167.60
" 8	He.	34.40	Hi.	71.20
" 9	He.	75. 0	K.	69.72
" 10	He.	55. 0	K.	64.60
" 11	He.	25. 0	K.	18.12

Ka ili, 97 akere 2 ruda 29 roda

6. E kaapuni i ka aina, e ku ana ke kanaka maloko o ka aina ma kahi hookahi i ikea mai ai na kihi a pau o ka aina.

E imi ka mea kaapuni aina i kona wahi e ku ai iloko o ka aina, kahi i ike maka ia ai na kihi, alaila, e imi me ka panana i ka moe ana o kela kihi a o keia kihi, a e ana me ke kaulahao mai kona wahi e ku ai a i na kihi a pau, a e kakau iho i na mea i loaa mai ma ka pepa.

(E nana i ke kii 15.)

E ku ke kanaka ma L a e imi i ka moe ana ma ka panana, a e ana i ka loa me ke kaulahao o LO, LP, LK, LA, LU, LN, a e kakau i na mea i loaa mai ma ka pepa. Eia paha ka mea i loaa mai.

		Degere.		K. p.
LN	A.	20	K.	8.70
LO	A.	60	Hi.	10.
LP	A.	87	Hi.	11.40
LK	He.	15	Hi.	10.50
LA	He.	60	K.	12.
LU	A.	65	K.	8.78

E hana i hoohalikeaina, penei,

E kaha i meridiana, e lawe i kiko ma ua meridiana la, a mai ia kiko, e kaha me ka poaihapalua a me ka upa i ka moe ana a me ka loa o na kaha a pau mai L a i kela kihi

keia kihi, alaila, e kaha i kaha pololei mai O a i P, a mai P a i K, a pela no a puni.

E imi i ka ili.

Ua maheleia ua aina nei i na huinakolu e like me LPO, a me PLK, a ua hoikeia mai na aoao elua a me ka huina mawaena i loaa mai ka ili, nolaila e imi i ka ili e like me ka Nanehai 3, o keia mokuna.

7. E kaapuni i ka aina, e ku ana ma kekahi kihi kahi i ikea ai na kihi e ae a pau. (E nana i ke kii 16.)

E ku ka mea kaapuni aina ma ke kihi kahi i nana makaia ai na kihi e ae a pau a e imi i ka moe ana o na kihi e ae a pau me ka panana a e ana me ke kaulahao mai kona wahi i ku ai a i na kihi a pau, a e kakau iho i na mea i loaa mai ma ka pepa.

Eia ilalo nei na mea i loaa mai me ka panana a me ke kaulahao.

		Degere.		K. p.
AN	A.	70	K.	14.60
AI	A.	50	K.	18.20
AK	A.	30	K.	16.80
AU	A.	10	K.	21.20
AO	A.	7	Hi.	16.95
AE	A.	30	Hi.	8.50

E kakau i ka hoohalikeaina, penei,

E kaha i meridiana e like me mamua e oki ana i ke kihi ma A, kahi i ku ai ke kanaka kaapuni aina; mai A e kaha aku i ka moe ana o na kihi a pau a e ana me ka rula kaha kaulike a me ka upa i ka loa o AN, AI, AK, AU, AO, AE, a e kaha i na kaha pololei mai N a i I, mai I a i K, a pela aku a puni.

E imi i ka ili e like me ka Nanehai 6, i hana iho nei.

8. E kaapuni i ka aina kekee loa na aoao a pau, aole hoi e hiki ke ana i na kekee liilii a pau. (E nana i ke kii 17.)

Ma ke kihi ma A e hoomaka ai, a e ana pololei iloko o ka aina a hiki i O; e kakau i ka moe ana a me ka loa o ia ana ana. E ana i na kaha kupono mai ke kaha AO a i 1 a me 2, 3, 4, a e kakau iho i ka loa o ia mau kaha

ma ka pepa, a e kakau hoi i ka loa mai ke kihi A, a i M, a i *a* hoi a me *e*. Pela no e hana'i a puni ka aina.

Eia ilalo nei ka mea i loaa mai me ka panana a me ke kaulahao.

Ka moe ana a me ka loa.	Na kaha kupono.	Ka moe ana a me ka loa.	Na kaha kupono.
K. p.	K. p.	deg. min. K. p.	K. p.
AO. A. 85 deg. Hi. 11.20	0.56	LP. He. 67.50 K. 8.20	0.40
K. p.		ma 1.34	0.36
ma 5.40 mai A. aku	1.40	ma 2.96	0.33
ma 8.26 mai A. aku	0.36	ma 5.88	1.00
ma *e*	0.36	ma P.	0.12
deg. min. K. p.			
OH. A. 7.20 Hi. 7.96	0.20		
mai O aku a i 2 36	0.36	PN. He. 27°.40m. Hi. 7.06	1.20
ma 4.28	0.86	ma 2.	0.24
ma Hi.	0.30	ma N.	0.16
K. p.			
HK. A. 62 degere K. 4.68		NA. He. 25°.20m. K. 6.48	
ma 4.34	0.30	ma 3.80	0.80
		ma A.	0.40
deg. min. K. p.			
KL. A 11.10 K. 4.20	0.30		

E imi i ka ili.

E imi mua i ka ili i puniia e na kaha maloko, alaila e imi i ka ili o na huinakolu, a me na huinahalikeole, a me na huinahalike, a hui pu ia me ka mea i loaa mai mamua; o ka ili no ia.

No ke kaapuni ana i ka aina ma ka helu wale no.

E ana pono i ka aina me ke panana a me ke kaulahao, a e kakau iho i ka moe ana a me ka loa o na aoao a pau, alaila, e hana i mea e like me keia:

HAAWINA 1.

He-lu.	Moe ana.	loa. K.	A.	He.	Hi.	K.	1 loa.	2 loa.	Hi. A.	Hi. He.
1	A. 15° 0′ Hi.	80	77.27 77.15	. . .	20.71 20.74	. . .	20.74	20.74	1600.0910	. . . . .
2	A. 37° 30′ Hi.	40	31.73 31.66	. . .	24.35 24.38	. . .	45.12	65.86	2085.1276	. . . . .
3	Hikina,	30	. . .	. . .	30. 0 30.04	. . .	75.16	120.28	. . . . .	. . . . .
4	He. 11° 0′ Hi.	50	. . .	49.08 49.15	9.54 9.56	. . .	84.72	159.83	. . . . .	7858.1020
5	Hema,	54	. . .	54. 0 54.10	. . .	. . .	84.72	169.44	. . . . .	9166.7040
6	Komohana,	40	. . .	. . .	. . .	40. 0 39.95	44.77	129.49	. . . . .	. . . . .
7	He. 36° 30′ K.	40	. . .	32.15 32.21	. . .	23.79 23.75	21.02	65.79	. . . . .	2119.0959
8	A. 38° 15′ K.	34	26.70 26.65	. . .	. . .	21.05 21.02	0. 0	21.02	560.1330	. . . . .
			135.70 135.46	135.23 135.46	81.60 81.72	84.81 84.72			4245.4016	19143.9019

19143.9019 . . . ke akoakoa ana o na ili hema.
4245.4016 . . . ke akoakoa ana o na ili akau.

2)14898.5003

744)92501 ka ili.
4

3)70004
40

28)00160

744 akere 3 ruda 28 roda.

11

Aia ma ka papa huhuihelu no na akauana, a me na hemaana, na hikinaana a me na komohanaana, e imi i ke akauana a me ka hemaana, i ka hikinaana a me ke komohanaana o kela aoao a me keia aoao, a e kakau iho i na hua helu i loaa mai ma kahi kupono i kona aoao, a malalo iho o na hoailona A. He. Hi. K.

E houluulu i na akauana, a me na hemaana, a ina he pololei ke kaapuni ana, ina ua like a like keia mau akoakoa ana elua. Pela no hoi e hana'i me na hikinaana a me na komohanaana, a ina he pololei ke kaapuni ana ina ua like a like keia mau akoakoa ana elua, aka, ina aole like a like, ina ua hewa ke kaapuni ana. E kaapuni hou ka pono, ke nui ka like ole o na akauana a me na hemaana, o na hikinaana a me na komohanaana.

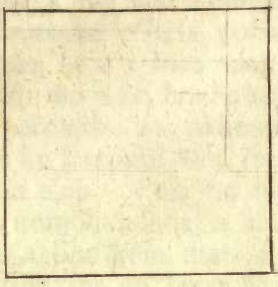
Aka, ina he mea uuku wale no ka like ole, alaila, e hoohalike aku wale no, ma ka houluulu a me ka hoolawe.

HAAWINA 2.

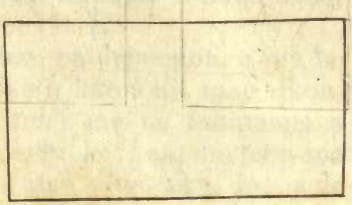
Helu.	Moe ana.	Loa.	Akau.	He.	Hi.	K.	1 loa	2 loa.	Hi. A.	Hi. He.
		k. p.								
1	A. 75° 0′ He.	54.8	14.2	. . .	52.9	. . .	144.1	235.3	3341.26	. . . .
2	A. 20 30 Hi.	41.2	38.6	. . .	14.4	. . .	158.5	302.6	11680.36	. . . .
3	Hikina,	64.8	. . .	. . .	64.8	. . .	223.3	381.8	. . . .	. . . .
4	He. 33 30 K.	141.2	. . .	117.7	. . .	77.9	145.4	368.7	. . . .	43395.99
5	He. 76 0 K.	64	. . .	15.5	. . .	62.1	83.3	228.7	. . . .	3544.85
6	Akau,	36	36	. . .	. . .	. .	83.3	166.6	5997.60	. . . .
7	He. 84 0 K.	46.4	. . .	4.9	. .	46.1	37.2	120.5	. . . .	590.45
8	A. 53 15 K.	46.4	27.8	. . .	. . .	37.2	0.0	37.2	1034.16	. . . .
9	A. 36 45 Hi.	76.8	61.5	. . .	46	. . .	46	46	2829	. . . .
10	A. 22 30 He.	56	51.7	. . .	21.4	. . .	67.4	113.4	5862.78	. . . .
11	He. 76 45 Hi.	43	. . .	11	46.7	. . .	114.1	181.5	. . . .	1996.50
12	He. 15 0 K.	43.4	. . .	41.9	. . .	11.2	102.9	217	. . . .	9092.30
13	He. 16 45 K.	40.5	. . .	38.8	. . .	11.7	91.2	194.1	. . . .	7531.08

Ka ili, 110 akere 2 ruda 23 roda.

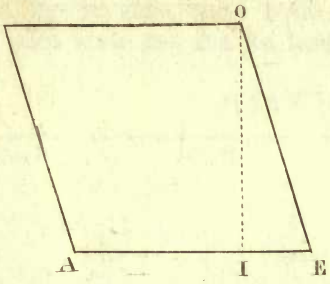
Kii 1.



Kii 2.



Kii 3.



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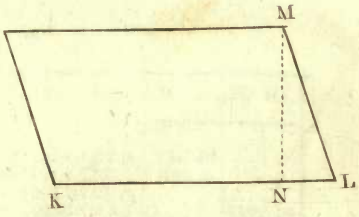

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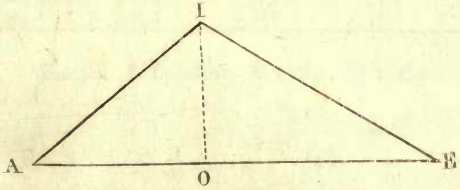

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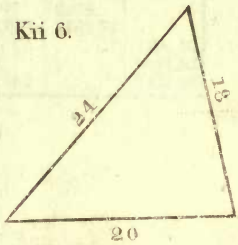

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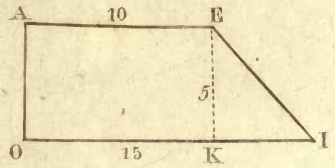

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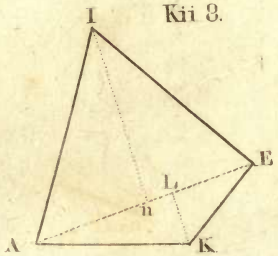
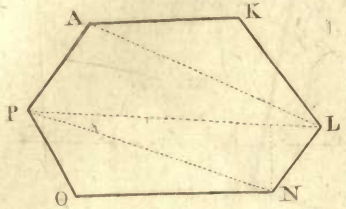


S.P.Kalama

Kii 9.



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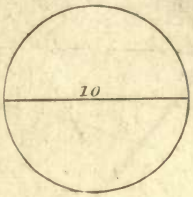

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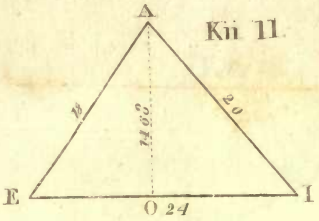

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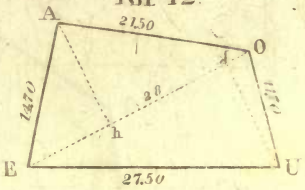

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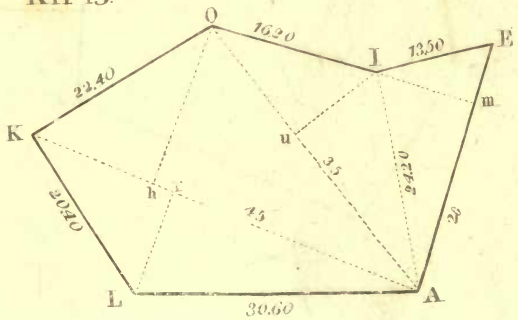

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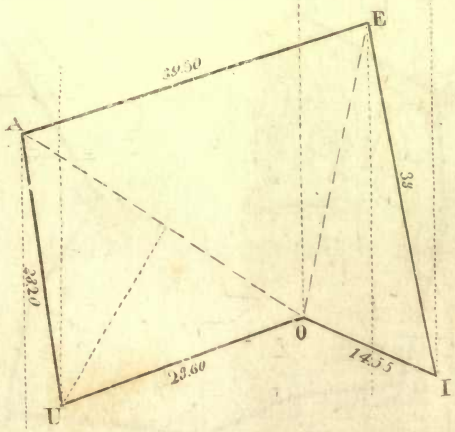

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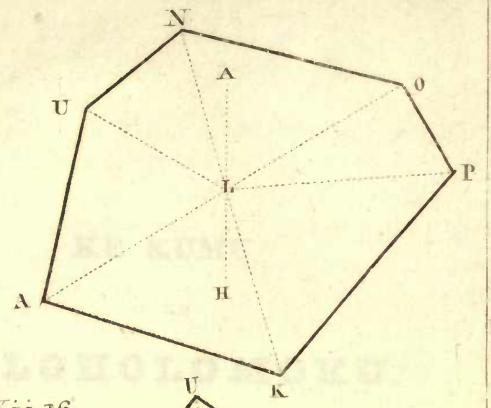
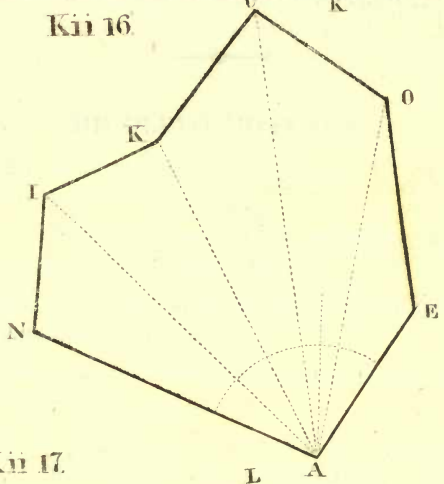
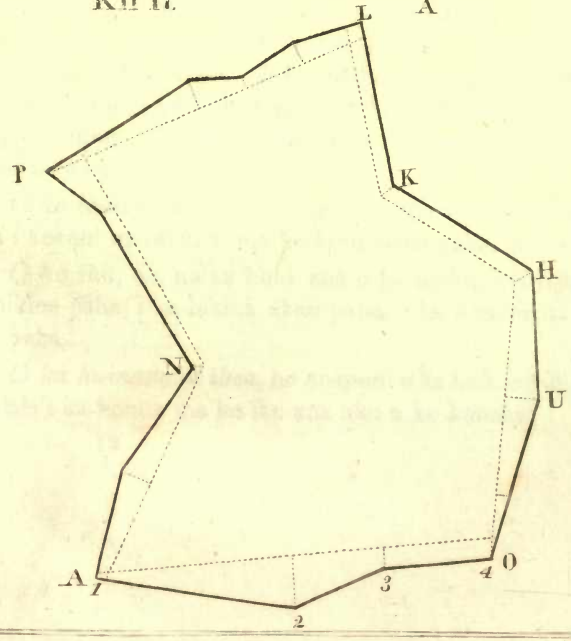


Kii 16.



Kii 17.



KE KUMU

O KA

HOLOHOLOMOKU.

HE OLELO HOAKAKA.

1 *O ka latitu*, o ka wa no ia i ana ia, mai ka poaiwaena aku, a hiki i na wahi a pau ma ka honua nei.

2 Mai ka poaiwaena aku, ma ka akau, ua kapaia *he latitu akau*; a ma ka hema, ua kapaia *he latitu hema.*

3 *O ka latitu okoa*, oia no ka wa mawaena o kekahi mau wahi ma ka honua i anaia ma ka meridiana.

4 *O ka lonitu*, oia no ka wa i anaia, mai kekahi wahi ma ka hikina aku, a ma ke komohana aku.

5 O Ladana, ma ka aina o Beretania kahi e helu ai ka nui o kanaka i ka lonitu. Mai Ladana aku ma ka hikina, i na wahi a pau a hiki i 180 deg., ua kapaia he *lonitu hikina.* Ua like a like no ia o ka puni ana o ka honua ma ka hikina aku. Mai Ladana aku hoi ma ke komohana i na wahi a pau a hiki i 180 deg., ua kapaia *he lonitu komohana.* Ua like a like no ia o ka puni ana o ka honua ma ke komohana aku.

6 *O ka lonitu okoa*, oia no ka wa i anaia mai kekahi meridiana aku a i kekahi meridiana, ma ke komohana paha, ma ka hikina paha.

7 *O ka ihu*, oia no ka holo ana o ka moku, ina paha i ka akau, i ka hikina paha, i ka hikina akau paha, i ke komohana paha, a i ka hema paha.

8 *O ka huinaaouli ikea*, he anapuni o ka lani, e pili pu ana kona ilihualala i ka honua ma ke ike ana aku a ke kanaka.

9 *O ka huinaaouli maoli*, he anapuni ia o ka lani, e oki ana kona awaeaa i ka honua ma ke kikowaena, a e kaulike ana me ka huinaaouli ilea.

10 Ina e kahaa ke kahu pololei mai ke kikowaena o ka honua a i kahi e kuana ke kanaka, a e hoolohiia ua lahi nei luna a lalo a pili i ka lani, ua kaaa kona welau e kupono a luna *kikowaenaoluna*, a o kona welau e kupono ana ilalo *kikowaenaolalo*. Nolila, o ke kikowaena luna a me ke kikowaena lalo he mau welau laa o ka huinaaouli maoli.

11 *O ka Hioana* o kekahi hoku, a o kekahi mea e ae paha ma ka lani; o ka wa no ia i anaia mai ua mea alu la a i ka poawaenahonua.

12 *O ka latitu* o kekahi hoku, a o kekahi mea e ae paha ma ka lani; oia no ka wa i anaia mai ke alanuihonua aku a hiki i ua mea la.

13 *O ka lonitu* o kekahi hoku, a o kekahi mea e ae paha ma ka lani; oia no ka wa i anaia mai ua mea la a hiki i ke kikonaua o ka Hipalane.

MOKUNA I.

NO KA IMI ANA I KA LATITU.

1 Ina ma ka akau na wahi elua, a ina paha ma ka hema, alaila, e lawe i ka latitu uuku noloko mai o ka latitu nui, a koe no ka *latitu okoa:* aka, ina ma ka akau kahi a ma ka hema kahi, e houluulu ia mau latitu, a oia no ka *latitu okoa.*

2 Nolaila, ina ma ka hemepere akau kekahi moku e holo ana i ka akau: a ina ma ka hemapere hema e holo ana ka moku i ka hema, alaila, ua mahuahua ka latitu o ka moku. Aka, ina ma ka hemepere akau e holo ana ka moku i ka hema: a ma ka hemepere hema e holo ana ka moku i ka akau, alaila, ua emi ka latitu o ka moku.

3 Nolaila hoi, ina iloko o ka latitu akau e holo ana ka

moku i ka akau; a iloko o ka latitu hema e holo ana ka moku i ka hema, o ka houluulu ana o kona latitu okoa a me kona latitu i haalele ai, oia no kona latitu i hiki ai.

4 Ina iloko o ka latitu akau e holo ana ka moku i ka hema, a iloko o ka latitu hema e holo ana ka moku i ka akau; o kona latitu i hiki ai oia no ke koena ke hoolaweia ka latitu okoa noloko mai o kona latitu i haalele ai.

5 Ina ua oi aku paha ka nui o ka *latitu okoa* i ko ka *latitu i haaleleia'i*, alaila, e hoolawe i ka latitu i haaleleia'i noloko mai o ka latitu okoa, a koe no ka latitu o ka moku: he latitu *inoa hou*, no ka mea, ua hala ka moku i kela aoao o ka poaiwaena honua.

He mau ui e akaka ai keia.

1 Heaha ka *latitu okoa* mawaena o Kuapehu ma Hawaii a me Waioli ma Kauai?

Noho mai o ka latitu o Waioli	22° 14′ A.
E hoolawe i ka latitu o Kuapehu	19 27 A.
Koe ka latitu okoa	2 47
	60
He mau mile	167

2 Ua holo aku kekahi moku i ka hema, mai ka lat. 59 deg. 27 min. hema aku a hala na mile 374, i ka latitu hea i hiki aku ai ua moku nei?

	deg. min.
E houluulu pu i ka lat. i haalele ia'i . . .	59° 27′ H.
A me ka lat. okoa . . . . . 374 ÷ 60 =	6 14 H.
Ka lat. i hiki ai ka moku	65 41 H.

3 Heaha ka lat. okoa mawaena o Lahaina ma Maui, a me Matavai ma Tahiti?

Ka lat. o Lahaina	20° 40′ A.
Ka lat. o Matavai	17 28 H.
Ka lat. okoa	38 08
	60
He mau mile	2,288

4 Holo aku kekahi moku mai ka lat. 28 deg. 15 min. A. a i ka hema 1800 mile; i ka lat. hea ia i hiki aku ai?

	deg.	min.	
Noloko mai o ka lat. okoa . 1800 ÷ 60 =	30°	00′	H.
E hoolawe i ka lat. i haaleleia'i.	28	15	A.
Koe ka lat. i hiki ai	1	45	H.

Ma neia ua maopopo, ua hala ka moku i kela aoao o ka poaiwaenahonua, no ka mea, ua oi aku ka latitu akoa i ka lat. i haaleleia mai ai.

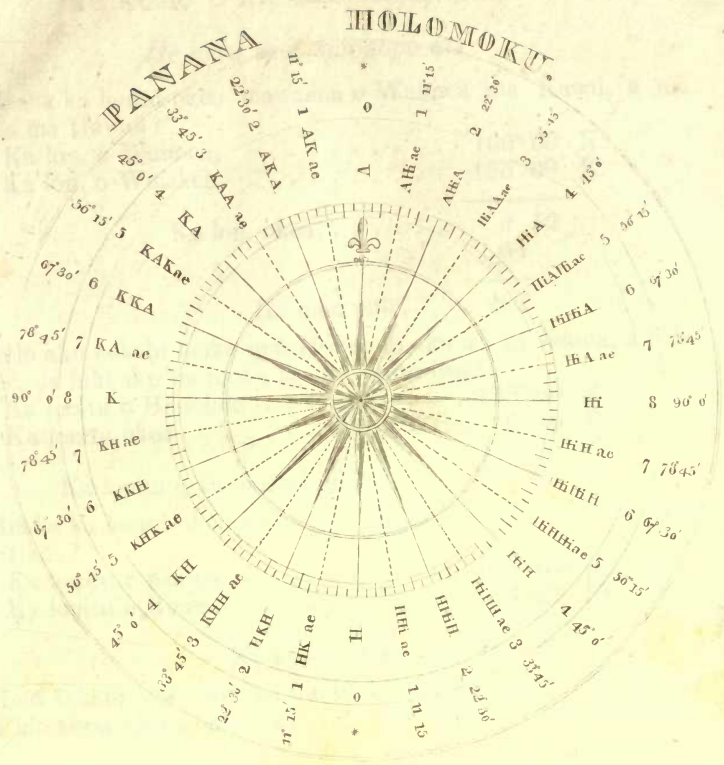
MOKUNA II.

NO KA IMI ANA I KA LONITU.

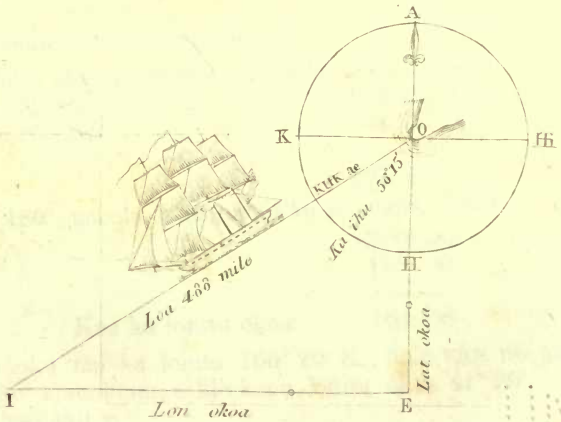
1 Ina ma ka hikina na wahi elua, a ina paha ma ke komohana, alaila, e lawe i ka lonitu uuku noloko mai o ka lonitu nui, a ua koe ka *lonitu okoa.* Aka, ina ma ka hikina kekahi wahi a ma ke komohana kekahi, o ka houluulu ana o ko laua mau lonitu, oia ka *lonitu okoa.*

2 Nolaila, i ka holo ana'ku i ka hikina iloko o ka lonitu hikina; a i ka holo ana'ku i ke komohana iloko o ka lonitu komohana, e houluulu i ka lonitu i haaleleia'i a me ka lonitu okoa, o ka lonitu ia o ka moku i hiki ai, ke ole kona pakela ana i 180 deg. A i oi aku ia i 180 deg., e hoolawe ia houluulu ana noloko mai o 360 deg. a koe mai ka lonitu o ka moku i hiki ai, he lonitu *inoa okoa* ia, okoa ko ka wahi i haaleleia mai ai.

3 Iloko o ka lonitu hikina e holo ana i ke komohana, a iloko o ka lonitu komohana e holo ana i ka hikina, e hoolawe i ka lonitu okoa noloko mai o ka lonitu i haaleleia'i, a koe ka lonitu o ka moku i hiki ai. Aka ina i oi aku ka nui o ka lonitu okoa i ko ka lonitu i haaleleia'i, alaila, e hoolawe i ka lonitu i haaleleia'i noloko mai o ka lon. okoa, a koe ka lonitu o ka moku i hiki ai; okoa keia lonitu, okoa ka lonitu i haaleleia'i.


HOLOMOKU'
PANANA
V
0
1 ИГ 15'
1 АК ае
АКА
22°30' 2
АКА
33°45' 3
КАА ае
45° 0' 4
КА
56°15' 5
КАКае
67°30' 6
ККА
78°45' 7
КА ае
90° 0' 8
К
78°45' 7
КНае
67°30' 6
ККН
56°15' 5
КНКае
45° 0' 4
КН
33°45' 3
КНН ае
22°30' 2
НКН
1 НК ае
П
1 ИП ае
2 22°30'
ИНП
3 33°45'
ИНПНае
4 45° 0'
ИКН
5 56°15'
ИКПКае
6 67°30'
ИКИК
7 78°45'
ИНае
8 90° 0'
Ни
7 78°45'
НИае
6 67°30'
НИБИ
5 56°15'
НИАВае
4 45°0'
ИНА
3 33°45'
ИВАае
2 22°30'
АИБА
1 АИБае
0
1 ИГ 15'
2 22°30'
3 33°45'
4 45°0'
5 56°15'
6 67°30'
7 78°45'

Kii 1.


A
K
0
Нь
КНК ае
56°15'
Ka ihu
Ei
Loa 4000 mile
Lat. ekoa
I
Lon ekoa
E

He mau ui e maopopo ai.

1 Heaha ka lonitu okoa mawaena o Waimea ma Kauai, a me Waiakea ma Hawaii?

Ka lon. o Waimea, ... 160° 00′ K.
Ka lon. o Waiakea, ... 155 08 K.

Ka lon. okoa, ... 4 52
60

He mau mile, 292

2 Holo aku kekahi moku mai Honolulu aku a i ka hikina, a hala 400 mile, ua hiki aku ua moku la i ka lonitu hea?

Ka lonitu o Honolulu . . . . . 158° 00′ K.
Ka lonitu okoa . . . . . 400 ÷ 60 = 6 40 Hi.

Ka lonitu o ka moku i hiki ai . . . 151 20 K.

3 Heaha ka lonitu okoa mawaena o Kailua ma Hawaii a me Roma ma Italia?

Ka lonitu o Kailua . . . . . 156° 04′ K.
Ka lonitu o Roma . . . . . 13 24 Hi.

Ka lonitu okoa . . . 169 28

4 Holo kekahi moku mai ka lonitu 15° 40′ Hi. aku a i ke komohana, a lilo kona lonitu okoa i 27° 15′. Ua hiki aku oia i ka lonitu hea?

Noloko mai o ka lonitu okoa . . . . . 27° 15′ K.
E hoolawe i ka lonitu i haaleleia'i . . . . 15 40 Hi.

Koe ka lonitu o ka moku i hiki ai . . . 11 35 K.

5 Heaha ka lonitu okoa mawaena o Nuioka a me Manila?

Ka lonitu o Manila . . . . . 121° 02′ Hi.
Ka lonitu o Nuioka . . . . . 74 00 K.

195 02

Ua oi aku keia i 180°, nolaila, e hoolaweia'ku ia noloko o 360°.

360° 00′
195 02

Koe ka lonitu okoa . . . 164 58

6 Aia kekahi moku ma ka lonitu 160° 20′ K., holo aku no oia mailaila aku a i ke komohana, a lilo kona lonitu okoa 41° 20′. I ka lonitu hea ia i hiki aku ai?

Ka lonitu i haaleleia'i . . . . . 160° 20′ K.
Ka lonitu okoa . . . . . 41 20 K.

201 40

No ka oi ana aku o keia i 180°, e hoolaweia oia noloko mai o 360°, no ka mea, ua hala aku ka moku a iloko o ka lonitu hikina.

360° 00′
201 40

Kona lonitu i hiki ai . . . 158 20 Hi.

MOKUNA III.

O KA HOLO ILILAUMANIA.

1 Ua hoikeia mai *ka ihu* a me *ka loa*. E imi i ka *latitu okoa*, a me ka *lonitu akoa*. Penei ka like ana:

Me ka like ana o ka hanai,
I ka loa i hoikeia,
Pela no ke koookoa o ka ihu,
I ka latitu okoa.

Me ka like ana o ka hanai,
I ka loa,
Pela no ke koo o ka ihu,
I ka lonitu okoa.

2 Ua hoikeia mai ka ihu a me ka latitu okoa; e imi i ka loa a me ka lonitu okoa. Penei ka like ana:

Me ka like ana o ke koookoa o ka ihu,
I ka latitu okoa,
Pela no ka hanai,
I ka loa.

Me ka like ana o ka hanai,
I ka latitu okoa,
Pela no ke kahapili o ka ihu,
I ka lonitu okoa.

3 Ua hoikeia mai ka ihu a me ka lonitu okoa; e imi i ka loa a me ka latitu okoa. Peneiia ka like ana:

Me ka like ana o ke koo o ka ihu,
I ka lonitu okoa,
Pela no ka hanai,
I ka loa.

Me ka like ana o ka hanai,
I ka lonitu okoa,
Pela no ke kahapili okoa o ka ihu,
I ka latitu okoa.

4 Ua hoikeia mai ka loa a me ka latitu okoa; e imi i ka ihu a me ka lonitu okoa. Penei ka like ana:

Me ka like ana o ka loa,
I ka hanai,
Pela no ka latitu okoa,
I ke koookoa o ka ihu.

Me ka like ana o ka hanai,
I ka loa,
Pela no ke koo o ka ihu,
I ka lonitu okoa.

5 Ua hoikeia mai ka loa a me ka lonitu okoa; a e imi i ka ihu a me ka latitu okoa. Penei ka like ana:

Me ka like ana o ka loa,
I ka hanai,
Pela no ka lonitu okoa,
I ke koo o ka ihu.

Me ka like ana o ka hanai,
I ka loa,
Pela no ke koookoa o ka ihu,
I ka latitu okoa.

6 Ua hoikeia ka latitu okoa a me ka lonitu okoa; a e imi i ka ihu a me ka loa. Penei ka like ana:

Me ka like ana o ka latitu okoa,
I ka hanai,
Pela no ka lonitu okoa,
I ke kahapili o ka ihu.

Me ka like ana o ke koo o ka ihu,
I ka lonitu okoa,
Pela no ka hanai,
I ka loa.

Me ka like ana o ka hanai,
I ka latitu okoa,
Pela no ke kahaoki o ka ihu,
I ka loa.

1 *Ua hoikeia ka ihu a me ka loa i loaa ka latitu okoa a me ka lonitu okoa.* (E nana i ke Kii 1, papa 1.)

Holo kekahi moku mai ka latitu 49° 57′ A. aku a i ke K. H. K. ae, a hala 488 mile. Heaha kona latitu i hiki ai? Heaha hoi kona lonitu okoa?

Ma ke ana ana.

E kaha i ka lalani O E i meridiana no kahi o ka moku i holo aku ai. Mai ka poe kiko kaula ma ka rula e lawe i 60 deg. me ka upa, a hookahi wawae ma O e kaha i ka panana A. Hi. H. K. Mai ka poe kiko kuhikuhi e lawe i 5 kuhikuhi ma ka upa, a e kukulu kahi wawae ma He. a e kau i kela wawae ma ka pio H. K., o ka ihu no ia; ma keia kiko e kaha i ke kaha O I 488 mile kona loa. Mai I e kaha aku i I E e kau like ana me Hi. K.; alaila, e ana i ka lonitu okoa E I ma na kahakaulike ma ka rula 405.8 mile; e ana hoi i ka latitu okoa E O 271.1 mile.

Ma ka helu ana.

E hoolilo i ka loa O I i hanai, alaila, e imi i ka lat. okoa, penei:

Me ka like ana o ka hanai	10.00000
I ka loa I O 488	2.68842
Pela no ke koookoa o ka ihu 5 kuhikuhi 56° 15′	9.74474
I ka latitu okoa 271.1	2.43316

E imi i ka lonitu okoa, penei:

Me ka like ana o ka hanai	10.00000
I ka loa I O 488	2.68842
Pela no ke koo o ka ihu 5 kuhikuhi 56° 15′	9.91985
I ka lonitu okoa 405.8	2.60827

Ma ka latitu akau ka moku e holo ana i ka hema, nolaila,

Noloko mai o ka latitu i haleleia'i . .	49° 57′ A.
E hoolawe i ka latitu okoa 271.1 ÷ 60 =	4 31 H.
Koe kona latitu i hiki ai . .	45 26 A.

Ma ka rula.

E imi i ka lonitu penei:

Ma ka lalani koo kuhikuhi e kau i kekahi wawae o ka upa ma ka hanai (8 no kuhikuhi ia) a e kau i kela wawae ma ka 5 o na kuhikuhi; me kela wehe ana no o ka upa, ma ka lalani helu, e kau i kekahi wawae ma ka 488, oia ka loa, alaila, ma kahi e kauia'i kela wawae, malaila e kakauia'i ka lonitu okoa 405.8.

E imi i ka latitu okoa penei:

Ma ka lalani koo kuhikuhi e kau i kahi wawae o ka upa ma ka hanai, a e kau i kela wawae ma ke 3 o na kuhikuhi, oia no ka ihu okoa. A ma ka lalani helu, me ia wehe ana no o ka upa, e kau i kekahi wawae ma ka 488, oia ka loa, alaila, ma kahi i kauia'i kela wawae, malaila i kakauia'i ka latitu okoa 271.

2. *Ua hoikeia ka ihu a me ka latitu okoa, i loaa ka loa a me ka lonitu okoa.*

Aia kekahi moku ma ka latitu akau 1° 45′, holo aku no ia i ka Hi. H. Hi. ae, a hiki i ka lat. 2° 46′ H. Ehia mile ka loa o kona holo ana, heaha hoi kona lonitu okoa? (E nana i ke kii 2 papa 2.)

Ma ke ana ana.

E kaha i ke kaha I E = 271 mile; e ana i ka huina ma E 56 deg. 15 min., e kaha hoi i ke kaha E A: ma I e kukulu i ke kaha kupono I A oia no ka lon. okoa = 406, a E A ka loa = 488.

Ma ka helu ana.

E hoolilo i ka lat. okoa I E i hanai, alaila e imi i ka lon. okoa penei.

Me ka like ana o ka hanai	10.00000
I ka lat. okoa = 271	2.43297
Pela no ke kahapili o ka ihu 5 kuhikuhi = 56° 15′	10.17511
I ka lon. okoa 405.6	2.60808

E hoolilo i ka loa A E i hanai, alaila e imi i ka loa penei.

Me ka like ana o ke koo okoa o ka ihu 5 kuhikuhi	9.74474
I ka lat. okoa = 271	2.43297
Pela no ka hanai	10.00000
I ka loa . . 487.8	2.68823

Ma ka rula.

Ma ka lalani kahapili kuhikuhi e kau i kekahi wawae o ka upa ma ka hanai (o ka 4 no ia o na kuhikuhi) a e kau no i kela wawae o ka upa ma ka 5 o na kuhikuhi; me kela wehe ana no o ka upa, ma ka lalani helu, e kau i kekahi wawae ma ka 271, oia ka lat. okoa, a ma kahi e kauia'i kela wawe, malaila no i kakauia'i ka lon. okoa = 405.6.

Ma ka lalani koo kuhikuhi, e kau i kekahi wawae o ka upa ma ka hanai (o ka 8 no ia o na kuhikuhi) a e kau no i kela wawae ma ke 3 o na kuhikuhi, oia ka ihu okoa: me ia wehe ana no o ka upa, ma ka lalani helu e kau i kekahi wawae ma ka 271, oia ka lat. okoa, a ma kahi i kauia'i kela wawae, malaila no i kakauia'i ka loa 488.

O na pauku i koe, o ke 3, 4, 5, *a me ka* 6, *ua hiki wawe i ka mea makaukau ma ke Anahuinakolu ke hana.*

He mau Ui.

1. Aia kekahi moku ma ka lat. 2° 10′ H. i holo aku no ia i ka A. Hi. ae 267 mile; ua hiki aku oia i ka latitu hea? Heaha hoi kona lonitu okoa? Lat. 2° 12′ A. Lon. okoa 52 mile.

2. Holo aku kekahi moku i ka H. K. H. mai kekahi awa ma ka lat. 41° 30′ A. aku, a hiki i ka lat. 36° 57′ A. Ehia mile ka loa oia holo ana? Ehia hoi o ka lon. okoa?
Ka loa 295.5 mile. Ka lon. okoa 113 mile.

3. Holo aku kekahi moku, mai kahi awa ma ka lat. 2° 30′ H.

aku a i ka H. K. H. 28° 7′ K. a lilo kona lon. okoa i 177 mile. Ehia mile ka loa o ia holo ana? Ua hiki aku hoi ka moku i ka latitu hea?

O ka loa 375.6 mile. Ua hiki aku i ka lat. 8° 1′ H.

4. Ua holo aku kekahi moku i ke K. H. mai ka lat. 21° 59′ H. aku a hala na mile 360: a ua loaa ka lat. ma ka nana ana i ka la 24° 49′ H. E hoike mai oe i kona ihu i holo ai, a me kona lonitu okoa.

O kona ihu, i ka H. 61° 49′ ma ke K.

Kona lonitu okoa 317.3 mile.

5. Ua holo aku kekahi moku i ka Hi. A. mai ka lat. 2° 9′ H. aku la 354 mile, a lilo kona lon. okoa i 150 mile. Ma ka ihu hea kona holo ana? a ua hiki aku i ka lat. hea?

Ka ihu A. 25° 4′ Hi. Ka lat. 3° 12′ A.

6. Holo aku i ke kau wahi mawaena o ke komohana a me ka akau, mai kekahi awa ma ka latitu hema 1° 59′ aku, a hiki i kekahi awa ma ka lat. akau 4° 8′. Mai ka meridiana o kela awa mua, a hiki i keia ma ke komohana 209 mile. E hai mai oe i ka ihu, a me ka loa mai ke awa mua a i ke awa lua.

Ka ihu A. 29° 40 K. Ka loa 422.2 mile.

7. Aha mau la mamua aku nei e ku ana makou ma ka lat. 3°25′ H. Ma ia hope mai ua holo pololei mai makou, ma ka ihu A. K. A. ae, penei ka holo ana 8 mile ma ka hora hookahi. Ua hiki aku makou i ka lat. hea? Heaha hoi ko makou lon. okoa?

I ka lat. 7° 13′.6 A. Lon. okoa 426.6 mile.

8. Aia kekahi moku e ku ana ma kekahi awa ma ka lat. 3° 52′ H. ke manao nei kona kapena e holo aku i kekahi awa e, e moe ana ma ka ihu K. A. K. ae ½ K. mai ona aku la, a ma ka lat. 4° 30′ A. Ehia mile ka loa mai ua moku nei aku a i keia awa, ehia hoi kona lon. okoa? Loa 1065 mile. Lon. okoa 939 mile.

9. Holo mai la kekahi moku, mai ka latitu 48° 17′ A. a i ka K. H. H. ae. Pela ia i holo ai a emi iho la ka Hoku akau i 2 degere. Ehia mile ka loa o kona holo ana? Ehia hoi mile kona lon. okoa?

Ka loa 144.3 mile. Ka lon. okoa 80.3 mile.

MOKUNA IV.

O KA HOLO ANA I O A I O.

E ku ana kekahi moku ma Koloa, ma ka latitu 21° 56′ A. a ma ka lon. 159° 48′. Holo aku la, i 8 mile, i ka Hi. ka ihu; alaila ladiapaute, a holo i ka A 12° K. i 4 mau mile. Ladiapaute hou aku a holo i ka He. 61° Hi. i 70 mile. Huli hou, no ka makani mamua mai, a holo i ka He. 27° Hi. i 50 mile. Ladiapaute hou aku a holo

i ka A 31° Hi. i 11 mile. Alaila ladiapaute hou no, a holo i ka He. 15° Hi. i 10 mau mile. Alaila hadili hou aku a holo i ka A 56° Hi. i 17 mile: a ku iho la ma Kou ma Oahu. Heaha ka latitu okoa, a me ka lonitu okoa mawaena o Koloa a me Honolulu? Ehia hoi mile ma ka lalani pololei mai Koloa aku a i Honolulu?

Ma ke ana ana. (E nana i ke kii 3 papa 2.)

Eia Koloa ma ke K. E kaha i ka meridiana K U a mai ka poe kiko kaula i lawe i 60 deg. ma ka upa e kau i ke-kahi wawae ma K, a kaha i ka poai i panana, a ma keia poai e kau iho ai i kela ihu keia ihu o ka holo ana. Mai K e kaha i ke kaha K A i 8 mile ka loa e ku pono ana i ka meridiana K M. Mai A e kaha i ke kaha A E e kau like ana me K 2 i 4 mile ka loa; mai E e kaha i ke kaha E I e kaulike ana me K 3 i 70 mile ka loa: a pela e kaha ai i I O = 30 mile e kaulike ana me K 4: a me O U = 11 mile e kau like ana me K 5: a me U W = 10 mile e kau like ana me K 6: a me W H = 16 mile e kau like ana me K 7.

E hui pu i ke K a me ka H me ke kaha H K, a e kau iho i ke kaha H M e ku pono ana i ka meridiana K M.

Alaila K H, oia ka loa mai Koloa aku a Honolulu = 114.1 mile: K M, o ka lat. okoa = 48.1 mile: M H o ka lon. okoa = 103.5 mile.

Ma ka helu ana.

E hana i papa Huhuihelu o ka lat. okoa a me ka lon. okoa, i 6 papa; a e hailona ia mau papa penei, *Ihu*, *Loa*, *A. H. Hi. K.* Malaila e kakau iho i na ihu a me na loa ma na papa pono. Alaila e imi i ka lat. okoa, a me ka lon. okoa o keia ihu kela ihu ma ka rula (e like me ka imi ana ma ka hakina 1 o ka Holo ililaumania) a e kakau iho ma na papa pono. Eia, ina ma ka hema ka ihu, e kakau i ka lat. okoa ma ka papa H.; ina ma ka akau ka ihu, e kakau i ka lat. okoa ma ka papa A.: a o ka lon. okoa, ina ma ke komohana, e kakau ma ka papa K; ina ma ka hikina, e kakau ma ka papa Hi. E houluulu i kela papa keia papa; a e imi i ka oi ana o ka A. a me ka H., o ka lat. okoa ia. A e imi hoi i ka oi ana o ka Hi. a me ke K., o ka lon.

okoa no ia. Me keia latitu okoa, a me keia lon. okoa, e hiki ai ke loaa ka ihu a me ka loa, e like me ka imi ana ma ka hakina 6 o ka Holo ililaumania.

Ma ka Papa Huhuihelu o ka lat. a me ka lon. e imi ai. Penei ka imi ana; e imi i na degere maluna paha, a malalo paha; a e imi i ka loa o ka holo ana ma na aoao, aia ka latitu okoa a me ka lonitu okoa ma ka lalani latitu a me ka lalani lonitu. Ina nui ka loa, aole loaa ma ka Papa Huhuihelu, e puunaue, alaila imi; a e hoonui i na mea i loaa mai me ka huahelu i puunaueia'i, oia ka lat. okoa a me ka lon. okoa.

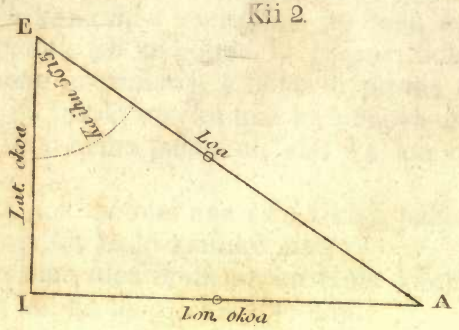
Papa Huhuihelu o ka latitu okoa a me ka lonitu okoa.

Na Ihu.	Na Loa.	A.	H.	Hi.	K
Hi.	8			8.0	
A. 12° K.	4	3.9			0.8
H. 61° Hi.	70		33.9	61.2	
H. 27° Hi.	30		26.7	13.6	
A. 31° Hi.	11	9.4		5.6	
H. 15° Hi.	10		9.7	2.6	
A. 56° Hi.	16	8.9		13.3	
		22.2	70.3	104.3	
			22.2	0.8	
			Latitu okoa 48.1	103.5	lonitu okoa.

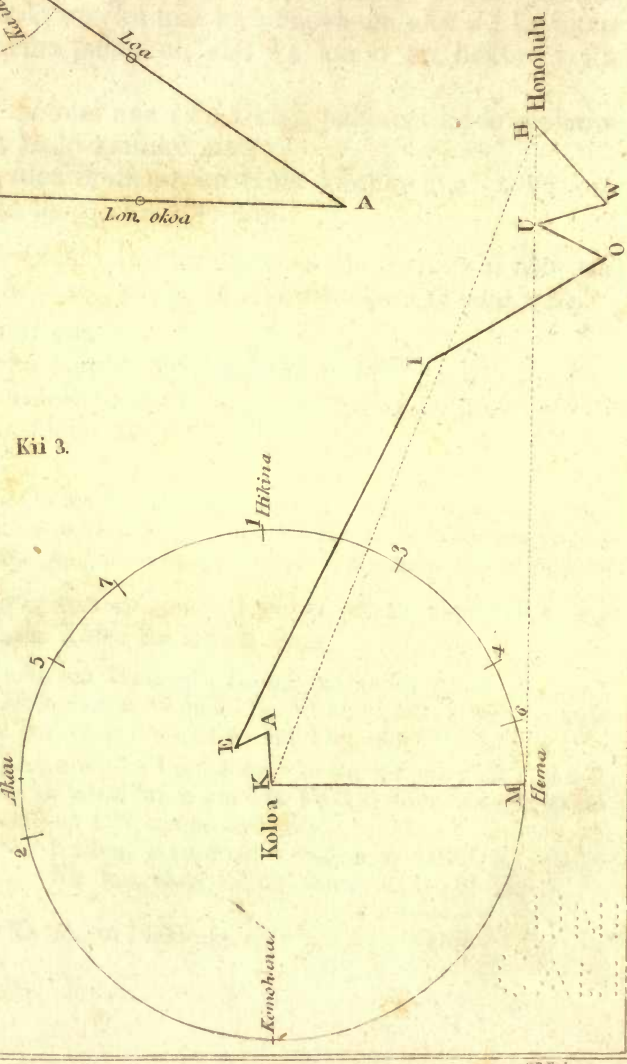
Penei ka imi ana i ka *ihu*, a me ka *loa* mai Koloa a i Honolulu.

Me ka like ana o ka lat. okoa 48.1 . .	1.68215
I ka hanai	10.00000
Pela no ka lon. okoa 103.5	2.01494
I ke kahapili o ka ihu 65° 4′	10.33279
Me ka like ana o ka hanai	10.00000
I ka latitu okoa 48.1	1.68215
Pela no ke kahaoki 65° 4′	10.37514
I ka loa 114.1	2.05729

Kii 2.


E
Kaihu 5615
Lat. okoa
Loa
I
Lon. okoa
A

Kii 3.


Honolulu
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Komohana

MOKUNA V.

O KA HOLO KAULIKE ANA.

Ma ka *Holo ililaumania*, ua manaoia ka honua he *ililaumania*, a o kona mau meridiana he mau *kahakaulike*. Aka, he *ilihualala* ko ka honua, he *poepoe*; nolaila ua hookokoke kona mau meridiana, a halawai pu ma na welau. Nolaila hoi, i ka holo ana'ku mai ka poaiwaena aku a i ka akau paha, i ka hema paha, ua emi ka loa o na dekere o ka lonitu.

O ka holo pololei ana i ka hikina paha a i ke komohana paha, oia ka Holo kaulike ana.

Elua mau mea imiia ma ka Holo kaulike ana: o ka *lon. okoa*, a me ka *loihi* o ka holo ana.

1. *Ua hoikeia mai ka lon. okoa iwaena o na wahi elua ma ke kaha lat. hookahi, i loaa ka loihi iwaena o ia mau wahi.*

Penei ka imi ana.

Ma ka Papa Lat. a me ka Lon. e imi i ka lat. ma kahi e kau ai na dekere, a ma ka aoao ma ka lalani loa e imi i ka *lon. okoa*, alaila aia e ku like ana ma ka lalani lat. ka *loa* i imi ai.

Aia kekahi moku ma ka lat. 49° akau paha, hema paha; holo aku la oia a i ka hikina paha, i ke komohana paha, a lilo kona lon. okoa i 3° 30′. Ehia mile ka loihi o ka holo ana? Ka loihi 137.8 mile.

2. *Ua hoikeia mai ka loihi mawaena o na wahi elua ma ka latitu hookahi i loaa ka lonitu okoa.*

Aia kekahi moku ma Waimea i Kauai, ma ka lat 22° A., a ma ka lon. 160° K. Holo aku la ua moku nei a i ka hikina, a hala na mile 111. Heaha ka lon. okoa? a ua hiki aku ka moku i ka lon. hea?

Ma ka Papa Lat. a me ka Lon. e imi i ka lat 22° ma kahi e kau ai na dekere; a ma ka lalani lat. e imi i ka loa 111 mile, aia ma ka lalani loa e ku pono ana 120, oia ka lon. okoa.

Ka lon. o ka moku i haalele ai 160° K.
Ka lon. okoa 120′ ÷ 60 = 2° Hi.

Ka lonitu i hiki aku ai . . . . . 158°

Eia mai kahi Papa e hoike mai ana i na mile iloko o ka dekere lonitu hookahi ma kela latitu keia latitu.

D. L.	Mile.	D. L.	Mile.	D. L.	Mile.	D. L.	Mile.	D. L.	Mile.
1	59. 99	19	56 73	37	47. 92	55	34. 41	73	17. 54
2	59. 96	20	56. 38	38	47. 28	56	33. 55	74	16. 54
3	59. 92	21	56. 01	39	46. 63	57	32. 68	75	15. 53
4	59. 85	22	55. 63	40	45. 96	58	31. 80	76	14. 52
5	59. 77	23	55. 23	41	45. 28	59	30. 90	77	13. 50
6	59. 67	24	54. 81	42	44. 59	60	30. 00	78	12. 47
7	59. 55	25	54. 38	43	43. 88	61	29. 09	79	11. 45
8	59. 42	26	53. 93	44	43. 16	62	28. 17	80	10. 42
9	59. 26	27	53. 46	45	42. 43	63	27. 24	81	9. 39
10	59. 09	28	52. 98	46	41. 68	64	26. 30	82	8. 35
11	58. 90	29	52. 48	47	40. 92	65	25. 36	83	7. 31
12	58. 69	30	51. 96	48	40. 15	66	24. 40	84	6. 27
13	58. 46	31	51. 43	49	39. 36	67	23. 44	85	5. 23
14	58. 22	32	50. 88	50	38. 57	68	22. 48	86	4. 19
15	57. 96	33	50. 32	51	37. 76	69	21. 50	87	3. 14
16	57. 68	34	49. 74	52	36. 94	70	20. 52	88	2. 09
17	57. 38	35	49. 15	53	36. 11	71	19. 53	89	1. 05
18	57. 06	36	48. 54	54	35. 27	72	18. 54	90	0. 00

MOKUNA VI.

KA HOLO LATITU WAENA ANA.

1 Ma ka holo kaulike ana, ua ikea ka lonitu okoa o ka moku e holo pololei ana i ka hikina paha, i ke komohana paha. Aka, aole i holo pinepine na moku pela. Nolaila, he pono ke imi i mea e akaka ai ka lonitu okoa, ke moe hio ka ihu o ka holo ana. (E nana i ke kii 4.)

2 Ina e holo aku ka moku mai A aku a hiki i I. Alaila, u h + l k + n I, oia no ka *loa meridiana*. Ua oi aku ka loa o E I i keia mau loa i houluuluia; a ua oi aku ka loihi o keia mau loa i houluuluia imua o A O. Nolaila, aole e anaia ka *loa meridiana* ma ka latitu o kahi i holo mai ai ka moku, aole no hoi ma ka latitu o kahi i hiki aku ai ka moku: aka, ua anaia ka *loa meridiana* ma kekahi lat. mawaena; a ua kohoia ka lat. mawaena konu, a ua kapaia oia ka *lat. waena*.

3 Ma ka holo latitu waena ana, ua hui pu ia mai ka holo ililaumania a me ka holo kaulike ana.

4 *Lat. waena.* O ka lat. o kahi i holo mai ai ka moku, a me kona lat. i hiki aku ai; ina ma ka akau ia latitu, ina paha ma ka hema; alaila, o ka hapalua o ka houluulu ana, oia no ka *lat. waena.*

Aka, ina ma ka akau kekahi, a ma ka hema kekahi, e hoolawe, a o ka hapalua o ke koena, oia no ka *lat. waena.*

Alaila, penei ka like ana.

Olelo hoakaka I.

Me ka like ana o ke koookoa o ka lat. waena.
I ka hanai,
Pela no ka loa meridiana,
I ka lon. okoa.

Olelo hoakaka II.

Me ka like ana o ke koookoa o ka lat. waena,
I ka loa,
Pela no ke koo o ka ihu,
I ka lon. okoa.

Olelo hoakaka III.

Me ka like ana o ke koookoa o ka lat. waena,
I ka lat. okoa,
Pela no ke kahapili o ka ihu,
I ka lon. okoa.

(1) O ka lat. o Koloa 21° 56′ A, a o kona lonitu 159° 45′ K. O ka lat. o Kaawaloa 19° 27′ A, a o kona lon. 156° 4′ K. Mahea ka moe ana o ka ihu mai Koloa aku a Kaawaloa? Ehia mile ka loa? Ehia hoi mile ka loa meridiana?

$$21° 56′ - 19° 27′ = 2° 29′ = 149′ \text{ Lat. okoa.}$$
$$159° 45′ - 156° 4′ = 3° 41′ = 221′ \text{ Lon. okoa.}$$
$$\frac{21° 56′ + 19° 27′}{2} = 20° 41′ \text{ Lat. waena.}$$

(E nana i ke kii 5.)

Ma ke ana ana. E kaha i ke kaha A I mai ka hikina a i ke komohana. Mai ka poe kiko kaula ma ka rula e lawe i 60 deg. me ka upa, a hookahi wawae ma A e kaha i ka

pio H K, a maluna o keia pio e ana iho i ka lat. waena 20 deg. 41 min. mai H a hiki i K. E kaha i ke kaha A K, a e hooloihi aku ia e like me ka loa o ka lon. okoa 221 A E. Mai ke kiko E e hookuu i ke kaha E I kupono i ke kaha A I, a e hooloihi i keia kaha e like me ka loa o ka lat. okoa I O 149 min. E hui pu A O. E kaha i ke kaha A L e kaulike ana me I O. Aia o Koloa ma A; a o Kaawaloa ma O; a o ka loa A O i anaia 255 mile no ia. A I ka loa meridiana 207. A o ka huina L A O, oia no ka ihu 54 deg. 15 min. Nolaila, o ka moe ana o ka ihu mai Koloa a Kaawaloa, oia no ka H. 54 deg. 15 min. Hi.

Ma ka helu ana.

Ma ka Olelo hoakaka III.

Me ka like ana o ka lat. okoa 149	2.17319
I ke koookoa o ka lat. waena 20° 41′ . .	9.97107
Pela no ka lon. okoa 221	2.34439
	12.31546
I ke kahapili o ka ihu = 54° 13′	10.14227

Ma ka Olelo hoakaka I.

Me ka like ana o ka hanai . 90°	10.———
I ka lon. okoa 221	2.34439
Pela no ke koookoa o ka lat. waena 20° 41′	9.97107
I ka loa meridiana . . . . . 206.7 . . .	2.31546

Ma ka Holo ililaumania ana.

Me ka like ana o ke koookoa o ka ihu 54° 13′ =	9.76695
I ka lat. okoa 149	2.17319
Pela no ka hanai. . . . 90°	10.00000
I ka loa 254.8	2.40624

Ma ka rula.

1 Ma ka lalani koo, e kau i kekahi wawae o ka upa ma

ka hanai, ma 90 deg.* a e kau i kela wawae ma 69 deg. 19 min., o ke koena ia ke hoolaweia ka lat. waena noloko o 90 deg.

Ma ka lalani helu, me keia wehe ana o ka upa, e kau i kekahi wawae ma ka lonitu okoa 221 min., alaila, ma kahi e kauia'i kela wawae, malaila ua kakauia ka *loa meridiana* 207 mile.

2 Ma ka lalani helu e kau i kekahi wawae o ka upa ma ka lat. okoa 149 min., a e kau i kela wawae ma ka loa meridiana 207.

Ma ka lalani kahapili, me keia wehe ana o ka upa, e kau i kekahi wawae ma ka hanai ma 45 deg., alaila ma kahi e kauia'i kela wawae, malaila ua kakauia na degere o ka ihu 54 deg. 13 min.

3 Ma ka lalani koo, e kau i kekahi wawae o ka upa ma ka ihu 54 deg. 13 min., a e kau i kela wawae ma ka hanai 90 deg.

Ma ka lalani helu, me keia wehe ana o ka upa, e kau i kekahi wawae ma ka loa meridiana 207, alaila, ma kahi e kauia'i kela wawae, malaila ua kakauia ka loa 255 mile.

(2) Aia no ke awa o Kou i Oahu, ma ka lat. 21° 19′ A. a ma ka lon. 158°. Holo aku kekahi moku mailaila aku a i ka H. 54° 52′ K. 138 mile, i na hora 36. E hoike mai oe i kona lat. a me kona lon. i hiki aku ai. (E nana i ke kii 6.)

Ma ka Holo ililaumamia.

Me ka like ana o ka hanai : loa 138′: : Koookoa o ka ihu 54° 52′: Lat. okoa 79′

Noloko mai o ka lat. o Kou . . . . 21° 19′ A.
E hoolawe i ka lat. okoa . . 79′ . 1. 19 H.

Kona lat. i hiki aku ai . . . . . 20. 00 A.

$\frac{21° 19′ + 20°}{2} = 20° 39′$ ka lat. waena.

---

* Ma na anapuni a pau, ua like loa keia mau mea ekolu me ka hanai.

O ke koo o . . . . 90°
O ke kahapili o . . 45° } = ka hanai.
O ke kaula o . . . 60°

Ma ka olelo hoakaka II.

Me ka like ana o ke koo } 20° 39′ : Loa 138′
okoa o ka lat. waena . . }
: : Ke koo o ka ihu 54° 52′ : Lon. okoa 120′
Noloko mai o ka lon. o Kou . . . . 158° K.
E hoolawe i ka lon. okoa . 120′ = 2 Hi.

Kona lon. i hiki aku ai 156° komohana.
O ka latitu keia, a me ka lonitu o Kawaihae i Hawaii.

(3) Holo aku kekahi moku mai kekahi awa ma ka lat. 49° 57′ A. a ma ka lon. 5° 14′ K, aku, a i ke kukulu hema 39° K. a hiki i ka lat. 45° 31′ A. Ehia mile ka loa o kona holo ana? Ua hiki aku hoi ia i ka lon. hea? (E nana i ke kii 6.)

Ma ka Olelo hoakaka III.

Me ka like ana o ke koookoa o ka lat. waena 47° 44′
: Kahapili o ka ihu 39 : : Latitu okoa . . . 265′
: Lonitu okoa 320.3
E houluulu pu ka lonitu . . . 5° 14′ K.
a me ka lon. okoa . . 320.3 = 5 20.3 K.

Kona lonitu i hiki aku ai . . 10 34.3 K.

Ma ka Olelo hoakaka II.

Me ka like ana o ke koo o ka ihu 39°
: Lonitu okoa 320.3
: : Ke koookoa o ka lat. waena 47° 44′
: Loa 342.3

(4) Aia kekahi moku i ka lat. 49° 57′ A. a i ka lon. 5° 14′ K. Holo aku la a hiki i ka lon. 23° 43′, e moe ana ka ihu mawaena o ke komohana a me ka hema, a o ka loa meridiana 789 mile. E hoakaka mai i kona ihu i holo ai, a me ka loa o ka holo ana, a me kona lat. i hiki aku ai. (E nana i ke kii 6.)

Ka ihu H. 51° 8′ K.
Latitu . . . 39 21 A.
Loa . . . 1013 mile.

MOKUNA VII.

KO MEREKATO HOLO ANA.

1 Ina he pokole kekahi holo ana, ua pono no ka *holo latitu waena ana:* aka, ina he loihi ka holo ana, aole pono

malaila. Hookahi wale no helu pono ana, ina he loihi ka holo ana; ua kapaia keia *ko Merekato holo ana*, mahope o ka inoa o *Merekato* ka mea nana ia i hoike mai ai.

2 Ma ka hana ana i ka palapala aina o Merekato, ua manaoia ka honua, he poepoe no; aole nae e hio mai ana na meridiana, a hui pu ma na welau, ua kaulike no. Nolaila, ua pono ka loa o ka wa mawaena o na meridiana ma ka poaiwaena wale no: mailaila aku a hiki i na welau, ua mahuahua mau aku. E like hoi me ka mahuahua ana o ka wa mawaena o na meridiana, pela no hoi ua hooloihiia 'ku na degere o ka latitu.

3 *O ka papa o na Hakina Meridiana.* Ina e maheleia na degere o kekahi meridiana maluna o ka mea poepoe, ua like pu wale no kela degere keia degere. Aka, ma ko Merekato palapala aina, ua mahuahua mau aku na degere, mai ka poaiwaena aku a hala loa i na welau; a o ka loa o keia mau degere e mahuahua ana, ua heluia, a ua kakauia ma ka *papa o na hakina Meridiana.* Ua kakauia na degere maluna a malalo, a ma na aoao na mile: a ma kahi kupono i ke degere a me ka mile, malaila i kakauia'i *na hakina meridiana.* (E nana i ka Papa Huhuihelu 3.)

4 *O ka latitu okoa meridiana*, o ka wa ia mai kekahi lat. a i kekahi latitu i anaia ma ka meridiana. Penei ka imi ana. Ina ma ka akau na latitu elua, a ina paha ma ka hema, alaila, e hoolawe i na hakina meridiana o ka lat. uuku noloko mai o na hakina meridiana o ka lat. nui, a koe no *ka lat. okoa meridiana.* Aka, e houluulu, ina ma ka akau kekahi, a ma ka hema kekahi. Penei.

Ka latitu o Waioli 22° 14′ A.	Na hakina meridiana 1369
Ka lat. o Kaawaloa 19 27 A.	Na hakina meridiana 1190
Ka latitu okoa 2 47′	Lat. okoa meridiana 179
Ka lat. o Honolulu 21° 19′ A.	Na hakina meridiana 1310
Ka lat. o Matavai i Tahiti 17 28 H.	Na hakina meridiana 1065
Ka lat. okoa 38° 47′	Lat. okoa meridiana 2375

5 Ina i hoikeia kekahi lat. a me ka lat. okoa meridiana, a ina ma ka akau laua a elua, ina paha ma ka hema, alaila, e hoolawe i ka lat. okoa meridiana noloko mai o na haki-

na meridiana o ka lat. nui, a koe no na hakina meridiana o ka lat uuku. A o ka houluulu pu ana o ka lat. okoa meridiana me na hakina meridiana o ka lat. uuku, oia no na hakina meridiana o ka lat. nui.

6 Ina ma ka akau kekahi latitu a ma ka hema kekahi, e hoolawe i na hakina meridiana o kekahi lat. noloko mai o ka lat. okoa meridiana, a koe no na hakina meridiana o kekahi latitu. Penei.

O ka latitu okoa meridiana mawaena o Nuioka a me Nuoleana oia no 793

Ka lat. o Nuoleana 29° 57′ A. Na hakina meridiana 1885

Ka lat. o Nuioka 40° 42′ A. Na hakina meridiana 2678

7 Ma ko Merekato holo ana, ua hookumuia ka helu ana, ma ka like pu ana o na huinakolu kupono elua; o na wawae o kekahi, *ka latitu okoa* a me ka *loa meridiana*; a o na wawae o kekahi *ka lat. okoa meridiana* a me ka *lonitu okoa*. (E nana i ke kii 7.)

Ma keia mau hinakolu kupono.

A E I a me A U O.
O ka huina E A I ka ihu,
Ka aoao A E Lat. okoa,
" A U Lat. okoa meridiana,
" E I Loa meridiana,
" U O Lon. okoa,
" A I Loa.

Ma ka like pu ana o keia mau huinakolu kupono, ua akaka keia like ana.

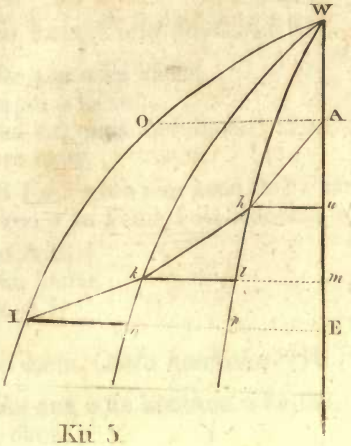
Me ka like ana o A E : A U : : E I : U O

Oia no keia *Olelo hoakaka* I.

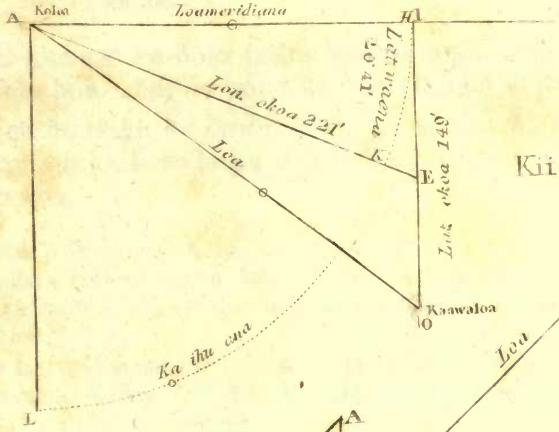
Me ka like ana o ka lat. okoa A E
I ka latitu okoa meridiana A U
Pela no ka loa meridiana E I
I ka lonitu okoa U O

Ma ka huinakolu A U O, e hoolilo ia A U i hanai, alaila
Me ka like ana o ka hanai,
I ke kahapili o ka huina A
Pela no ka aoao A U
I ka aoao . . . U O

Kii 4.



Kii 5



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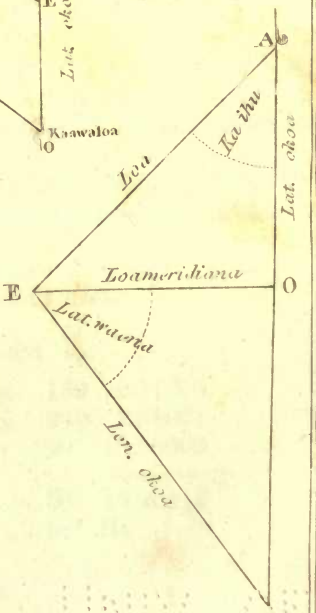
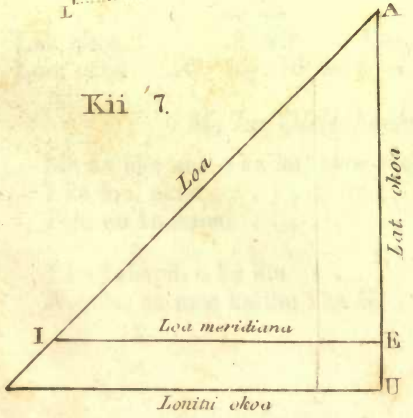
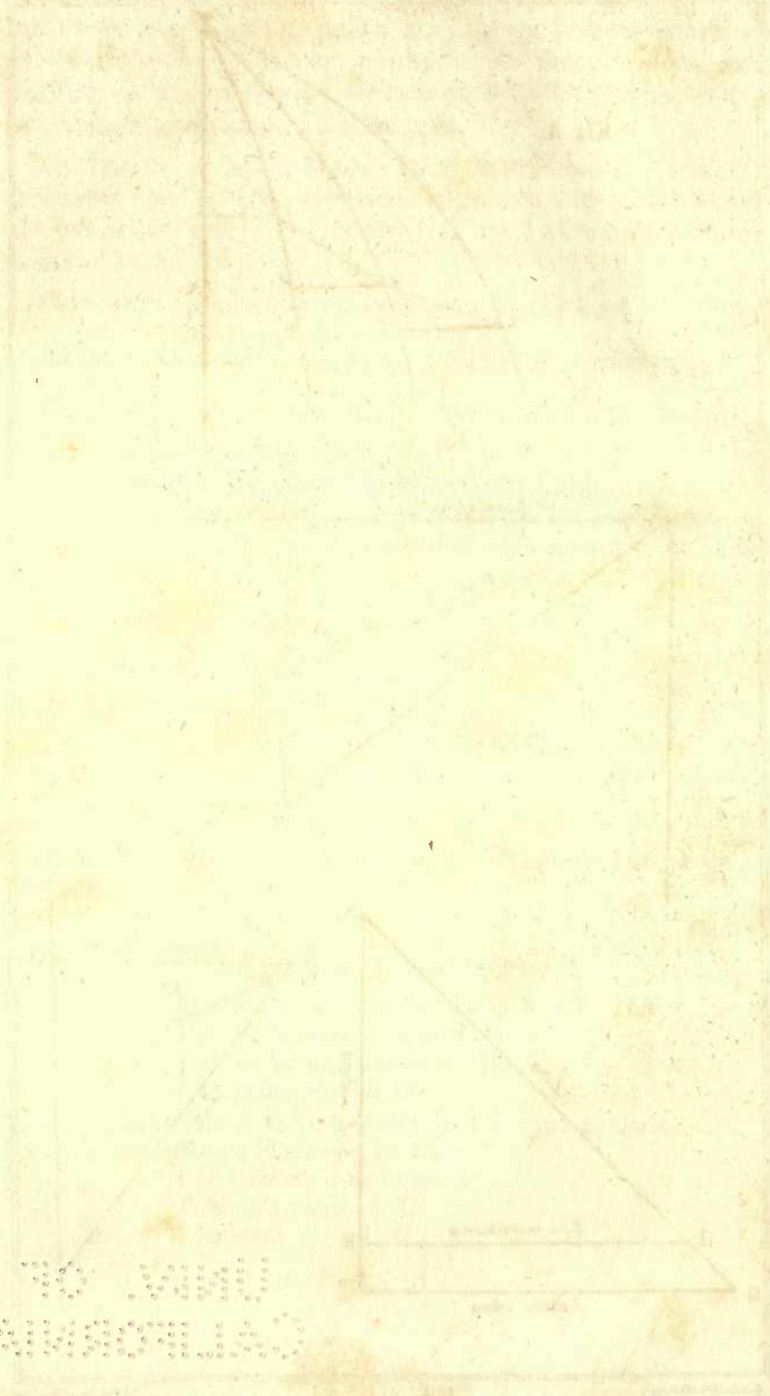


Kii 7.





Oia no keia *Olelo hoakaka* II.

Me ka like ana o ka hanai,
I ke kahapili o ka ihu,
Pela no ka lat. okoa meridiana,
I ka lonitu okoa.

Ma ka huinakolu A E I e hoolilo i ka aoao A I i hanai, alaila,
Me ka like ana o ke koo o ka huina I = Koookoa o ka huina A
I ka aoao A E,
Pela no ka hanai,
I ka aoao A I.

Oia no keia *Olelo hoakaka* III.

Me ka like ana o ke koookoa o ka ihu,
I ka lat. okoa,
Pela no ka hanai,
I ka loa.

8 E like me ka holo latitu waena ana, pela no ma ko Merekato holo ana, he pono ke hoikeia mai kekahi latitu.

9 Ina he uuku ka *latitu okoa*, ua oi aku ka pono o ka helu ana ma ka holo latitu waena ana, imua o ko Merekato holo ana.

(1) Aia o Waimea i Kauai ma ka lat. 22° A, a ma ka lon. 160° K. A o Kailua i Hawaii ma ka lat. 19° 40′ A, a ma ka lon. 156° K. Mahea ka moe ana o ka ihu mai Waimea aku a Kailua? Ehia hoi mile ka loa? (E nana i ke kii 7.)

Ka lat. o Waimea	22°	A.	Na hakina meridiana	1354
Ka lat. o Kailua	19 40′	A.	Na hakina meridiana	1204
Lat. okoa . .	2° 20′		Lat. okoa meridiana	150

Lon. okoa 160° — 156° = 4° = 240 mile.

Ma ka Olelo hoakaka II.

Me ka like ana o ka lat. okoa mer.	150	2.17609
I ka lon. okoa	240	2.38021
Pela no ka hanai	90°	10.00000
I ke kahapili o ka ihu	58°	10.20412

Nolaila, ua moe ka ihu i ka H. . . . 58° Hi.

Ma ka Olelo hoakaka III.

Me ka like ana o ke koookoa o ka ihu 58° 9.72420
: Latitu okoa 2° 20′ = 140′ 2.14613
: : Ka hanai 90 . . . . . 10.———

: Ka loa 264.2 . . . . . 2.42193

(2) E ku ana kekahi moku ma ka lat. 49° 57′ A, a ma ka lon. 5° 15′ K. Holo aku la a i ka H. 39° K. a hiki i ka lat. 45° 31′ A. Ua hiki aku oia i ka lon, hea? Ehia hoi mile ka loa o kona holo ana?

Lat. i holo mai ai 49° 57′ A. Na hakina merid'ana 3470
Lat. i hiki aku ai 45 31 A. Na hakina meridiana 3074

Ka lat. okoa . . . 4° 26′ = 266 Lat. okoa merid. 396

Ma ka Olelo hoakaka III.

Me ka like ana o ke koookoa o ka ihu 39° 9.89050
I ka lat. okoa . . . . 266′ 2.42488
Pela no ka hanai . . . 90° . . . . . 10.———

I ka loa . . . . . 342.2 . . . . . 2.53438

Ma ka Olelo hoakaka II.

Me ka like ana o ka hanai . . 90° . . . 10.———
: Kahapili o ka ihu . . . . . 39 . . . 9.90837
: : Ka lat. okoa meridiana . . 396 . . . 2.59770

: Ka lon. okoa . . . . 320′.7 = 5° 20′7 . 2.50607
5 15

Ka lon. o ka moku . . . . . 10° 35′.7

(3) Holo aku kekahi moku i ka hema o ke komohana, mai ka lat. 49° 57′ A.; lon. 5° 14′ K. a hiki i ka lat. 39° 20′ A. A o ka loa meridiana o kona holo ana 789 mile. E hoike mai i na degere o kona ihu, a me ka loa o ka holo ana, a me kona lon. i hiki aku ai.

49° 57′ A. Hakina meridiana 3470
39 20 A. Hakina meridiana 2571

Lat. okoa . 10° 37 = 637′. Lat. okoa meridiana 899

Ma ka Olelo hoakaka I.

Me ka like ana o ka lat. okoa 637′ . . . 2.80414
: Lat. okoa meridiana . . . . 899 . . . 2.95376
: : Loa meridiana . . . . . 789 . . . 2.89708

2.85084

: Lonitu okoa . . . . . 1113′ . . 3.04670
Ka lon. o kahi i holo mai ai ka moku . 5° 14′ K.
Ka lon. okoa 1113′ ÷ 60 = ... 18 33 K.

Ka lonitu o ka moku, 23 47 K.

Ma ka Olelo hoakaka II.

Me ka like ana o ka lat. okoa mer. 899 2.95376
: Lon. okoa 1113 . . . . . 3.04670
: : Ka hanai 90° . . . . . 10.———

: Kahapili o ka ihu 51° 5′ 10.09294

Ma ka Olelo hoakaka III.

Me ka like ana o ke koookoa o ka ihu 51° 5′ 9.79809
: Lat tu okoa . . . 637 . . . . . 2.80414
: : Ka hanai . . . . 90° . . . . . 10.———

: Loa . . . . . 1014 . . . . . 3.00605

(4) Holo aku la kekahi moku mai kekahi awa, aia ma ka lat. 14° 45′ A. a ma ka lon. 17° 33′ K. Moe aku la kona ihu i ka H. 28° 7½′ K. A ma ka nana mahina ana, loaa kona lonitu 29° 26′ K. Ehia mile ka loa o kona holo ana? Ua hiki oia i ka lat. hea?

Kona lon. i hiki aku ai . . 29° 26′ K.
Kona lon. i holo mai ai . . 17 33 K.

Ka lonitu okoa . . . . . 11 53 = 713′

Ma ka Olelo hoakaka II.

Me ka like ana o ke kahapili o ka ihu 28° 7½′ 9.72795
: Ka hanai 90° . . . . . 10.———
: : Ka lon. okoa 713′ 2.85309

: Ka lat. okoa meridiana 1334 H. 3.12514

Ka lat. okoa meridiana 1334
Lat. o ke awa 14° 45′ A. Hakina meridiana 895 A.

Lat. o ka moku 7 18 H. Hakina meridiana 439 H.

Lat. okoa . . . . 22 03′ = 1323′

Ma ka Olelo hoakaka III.

Me ka like ana o ke koookoa o ka ihu 28° 7½′ 9.94543
: Lat. okoa 1323 . . . . . 3.12156
: : Ka hanai 90° . . . . . 10.———

: Ka loa . . . 1500 mile 3.17613

(5) Holo aku kekahi moku 300 mile, mawaena o ka akau a me ke komohana, mai ka lat. 37° A, a hiki i ka lat. 41° A. Ma ka ihu hea kona holo ana? Heaha hoi kona lon. okoa?

41° Hakina meridiana 2702
37 Hakina meridiana 2393

Lat. okoa 4° = 240′ Lat. okoa meridiana . . 309

Ma ka Olelo hoakaka III.

Me ka like ana o ka loa 300 . . . . . 2.47712
: Ka hanai . . . . . 90° 10.00000
: : Ka lat. okoa . . . . 240′ 2.38021

: Koookoa o ka ihu A. 36° 52′ K. 9.90309

Ma ka Olelo hoakaka II.

Me ka like ana o ka hanai 90° 10.00000
: Kahapili o ka ihu . . . 36 52′ 9.87501
: : Ka lat. okoa meridiana 309 . . . . . 2.38996

: Lon. okoa . . 231′.7 = 3° 51′.7 . . . . . 2.36497

(6) Ma ka lat. 26° 13′ A. kekahi moku: holo aku la a i ka H. 27° K. 231 mile. Heaha kona lat. okoa, a me kona lon. okoa?

Ma ka Olelo hoakaka III.

Me ka like ana o ka hanai 90° 10.00000
: Ka loa . . . . . 231 . . . . . 2.36361
: : Ke koookoa o ka ihu 27° 9.94988

: Lat. okoa . . . . . 205.8 = 3° 25′.8 2.31349

Kona lat. i hiki aku ai 26° 13′—3° 25.8 = 22° 47′.2
26° 13′ Na hikina meridiana 1631
22 47 Na hakina meridiana 1405

Lat. okoa meridiana 226

Ma ka Olelo hoakaka II.

Me ka like ana o ka hanai 90° 10.00000
: Kahapili o ka ihu . . . 27 . . . . . 9.70717
: : Lat. okoa meridiana 226 . . . . . 2.35411

: Lon. okoa 1° 55′ = 115′ 2.06128

(7) Mai ka lat. 14° H. i holo aku kekahi moku 260 mile, mawaena o ka hema a me ke komohana, a lilo kona loa meridiana i 173 mile. Mahea kona ihu? Heaha kona lat. okoa, a me kona lon. okoa?

(E nana i ke kii 7.)

Ma ka Olelo hoakaka III.

Me ka like ana o ka loa 260 . . . . . 2.41497
: Hanai 90° 10.00000
: : Ka loa meridiana 173 . . . . . 2.23805

: Koo o ka ihu H. 41° 43′ K. 9.82308
Me ka like ana o ka hanai 90° 10.00000
: Ka loa . . . . . 260 . . . . . 2.41497
: : Koookoa o ka ihu 41° 43′ 9.87300

: Lat. okoa . . . . . 194′ 2.28797
Kona lat. i holo mai 14° H. Hakina meridiana 848
Lat. okoa 194° ÷ 60 = 3 14′ H.

Latitu i hiki aku ai 17° 14′ Hakina meridiana 1050

Lat. okoa meridiana 202
Me ka like ana o ka lat. okoa 194′ 2.28797
: Lat. okoa meridiana . . . . 202 . . . . . 2.30535
: : Ka loa meridiana . . . . 173 . : . . . 2.23805

4.54340

: Lon. okoa . . . . . 3° = 180′ 2.25560
Ka ihu 41° 43′
Lat. okoa 3 14
Lon. okoa 3 00

(8) Aia ka moku ma ka lat. 50° 10′ H. a me ka lon. 30°, a holo aku ia i ka Hi. Hi. H., a lilo kona loa meridiana 957 mile. Ehia mile o kona holo ana? Heaha hoi kona lat. a me kona lon. i hiki aku ai?

(E nana i ke kii 7.)

Ka loa 1036
Ka lat. 56° 46′.4 H.
Ka lon. 56° 40 Hi.

MOKUNA VIII.

NO KA PARALAKE, KE PELUANA, A ME KA HINA ANA O KA HUINAAOULI.

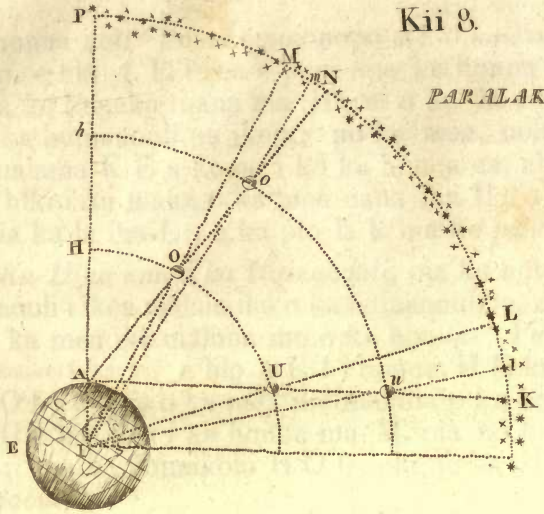
1. *Ka Paralake*, o ka wa ia mawaena o ke kiekie o ka la, ka mahina, ka hoku paha, ke anaia oia e kekahi e ku ana ma ke kikowaena o ka honua, a me kona kiekie ke anaia oia e kekahi e ku ana ma kau wahi maluna o ka honua.

(E nana i ke kii 8.)

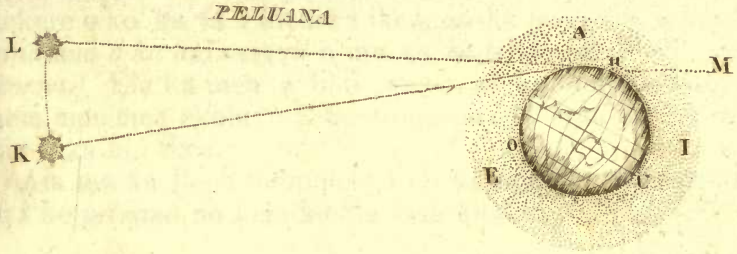
Ma ka manao ana e lilo *A E I* i honua, a o *I* ke kiko waena, *A* kahi e ku ana ka mea nana e ana: *H O U* he alanui o ka mahina; a *h o u* he alanui o kekahi hokuhele: a *P K* he kau wahi o ko ka hoku lani. Alaila ina aia ka mahina ma *O*, ina ua hoohalikeia oia me ka hoku ma *N* e ka mea ana e ku ana ma *A*; a e hoohalikeia hoi me ka hoku ma *M* e ka mea ana e ku ana ma *I*; a o ka loa *M N* oia no ka *paralake*. Pela hoi ina ma *U* ka mahina alaila *L K* kona *paralake*. Ua oi aku ka paralake ma ka huinaaouli, a ua emi mailaila aku a hiki i ke kikolunapono, malaila aole paralake. Ua uuku ka paralake o ka mea loihi aku i ka honua, a ua nui ka paralake o ka mea kokoke mai; *L K* ka paralake o ka mahina ma *U*, ua oi aku ia i *l K* ka paralake o ka hoku hele ma *u*.

2. *Ke Peluana*. Aole pololei ka holo ana o ka malamalama ke komo aku ia iloko o kekahi mea paapu iki ae, iloko o ka ohu paha, iloko o ka wai paha; aka ua peluia kona holo ana. Penei e hoomaopopo ai; e waiho i kekahi pohaku iki iloko o kekahi bola, a e ku ma o iki aku a nalo ka pohaku; alaila e ninini mai kekahi i ka wai iloko o ka bola a piha, ea mai no ka pohaku. Pela no ka malamalama o na mea ma ka lani i peluia'i, ke komo mai ia iloko o ke ea

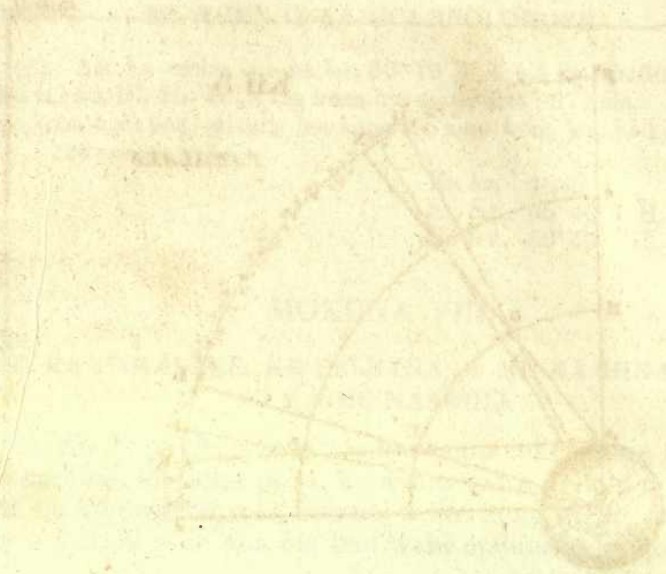
Kii 8.



Kii 9.



Kii 10.



o ka honua nei. Penei e maopopo ai: (E nana i ke kii 9.) ma ka manao, e lilo *A* E I i ea e puni ana ka honua O U H: e ku ana ke kanaka nana ma H: a o ka la ma K malalo iho o ka huinaaouli ua ikeia; no ka mea, holo pololei ka malamalama K E a komo i ko ka honua ea, alaila, ua peluia a hiki i ka maka o ka mea nana ma H; a kuhi iho la oia, aia ka la ma L: o ka pio L K oia ke *peluana.*

3. *Ka Hina ana o ka Huinaaouli*, oia ka huinakolu o ka huinaaouli i ikea malalo iho o ka huinaaouli io, no ka kiekie ana o ka mea ike maluna iho o ka honua. Penei e akaka ai; (E nana i ke kii 10.) e lilo A E I i honua, H K ka huinaaouli io, A O ke kiekie o ka mea ike maluna o ka honua; alaila O M U e pili ana i ka honua ma M, oia no ka huinaaouli i ikea; a o ka huinakolu H O U, oia no ka *Hina ana o ka Huinaaouli.*

4. O ka poe holoholomoku, i nana lakou i ka la me ka ohenana la, he mea mau ia lakou ke hooponopono i na dekere o ko ka la i kiekie i ikea, no ka *paralake*, a me ka *hina ana o ka huinaaouli* a me ka *hapalua o ko ka la ana-waena.* Eia ka mea e hiki wawe ai ke hooponopono i neia mau mea ekolu. E houluulu pu i 12 min. me ke kiekie o ka la i ikea.

Aia ma ka Papa huhuihelu VIII ka mea e hooponopono ai i ke *peluana* no kela kiekie keia kiekie.

MOKUNA IX.

NO KA IMI ANA I KA HIOANA O KA LA.

Ua hoikeia mai ka hioana o ka la ma ke awakea o kela la keia la ma Ladana, aia no ma ka *Alemanaka Holoholomoku*, a i ole ia aia ma ka Papa Huhuihelu IV. Alaila, e hiki no ke imi aku a loaa no kona hioana ma na meridiana e ae.

Penei ka imi ana.

E lawe i ka hioana no ke awakea ma Ladana noloko mai o ka Alemanaka Holoholomoku paha, noloko o ka

Papa Huhuihelu IV paha. Alaila, e imi i ka lon. mai Ladana mai ma ka Papa Huhuihelu V maluna; a o ka la o ka mahina ma ka lalani ma ka aoao; ma kahi e ku pono ana me keia mau mea, ua kakauia na minute a me na sekona e hooponopono ai i ka hioana: E houluulu pu paha, e hoolawe paha, e like me ia i kuhikuhiia mai ai ma ua Papa Huhuihelu nei.

Heaha ka Hioana o ka la ma ke awakea i ka la mua o Iulai 1838, ma Waimea i Kauai, ma ka loni. 160° K.?

Ka Hioana ma Ladana Iulai 1, 1838			23° 9′
Ka hooponopono ana no Iulai 1, lon. 160°. E hoolawe			00 1′ 57″
Ka Hioana ma Waimea Iulai 1, 1838	23	7′	3″

MOKUNA X.

O KA IMI ANA I KA LATITU MA KA NANA ANA I KA LA.

O ka latitu o ke kau wahi, oia no kona loihi mai ka poaiwaena aku, a ua anaia ka lat. ma ka pio o ka meridiana mawaena o ke kikowaenaoluna a me ka poaiwaena. Nolaila ina e hoikeia ka wa mawaena o kekahi mea ma ka lani a me ke kikowaenaoluna, i kona ku pono ana ma ka meridiana, a me kona hioana; alaila, ua hiki no ke loaa mai ka latitu.

Me ka ohenanala, ua loaa ka loihi o ka wa mawaena o ke kikowaenaoluna, a me ka mea i nanaia.

Aole pololei loa ke kiekie o ka la a me ka mahina i anaia ma ka moana, eha mau hooponopono ana e pono ai. *No ka hapalua o ke anawaena, no ka hina ana o ka huinaaouli, no ke peluana, a no ka paralake.*

E hoolawe i ke *peluana* noloko mai o ke kiekie i ikea; a e houluulu pu mai i na minute 12′ i mea e hooponopono ai no *ka hapalua o ke anawaena*, a no ka *paralake*, a me ka *hina ana o ka huinaaouli*, oia ke *kiekie io*. E hoolawe i ke kiekie io noloko mai o 90°, a koe no *ka loa kikowaenaoluna*.

Ina ma ka aoao hema ka la i kona ku ana ma ka meri-

diana, alaila e kapa aku i ka *loa kikowaenaoluna*, he *akau*; aka ina ma ka aoao akau ka la, alaila e kapa aku i ka *loa kikowaenaoluna*, he *hema*.

Malalo iho o ka hioana e kakau ai i ka *loa kikowaenaoluna*, a ina hookahi inoa o laua e houluulu pu, a o keia houluulu ana o ka latitu no ia; aka, ina okoa ka inoa o kekahi, a okoa ka inoa o kekahi, alaila e hoolawe i kekahi noloko mai o kekahi, a koe no ka latitu; a he lat. akau ia, ina he akau ka inoa o ka helu nui; a he lat. hema, ina he hema ka inoa o ka helu nui.

Eia hoi keia, ina ma ka poaiwaena ka la, aole ona hioana, alaila o ka *loa kikowaenaoluna* oia ka latitu.

A ina ma ke kikowaenaoluna ka la, alaila o ka hioana oia ka latitu.

(1) I ka la 1 o Novemaba 1837, nana aku la au i ka la me ka ohenanala, ma Waioli, i ka lonitu 160 K. I ka aoao hema ka la; a ku pono ma ka meridiana 52° 43′ kona kiekie i anaia'i. E hoike mai oe i ka latitu o Waioli?

	O ke kiekie i ikea	52° 43′
Ka hooponopono ana no ka paralake, ka hina ana o ka huinaaouli a me ka hapalua anawaena o ka la		+ 12′
⊙ kiekie io	52	55
E hoolawe i ke kiekie noloko mai o	90	00
Koe ka loa kikowaenaoluna	37	05 A.
⊙ Hioana (Huhuihelu IV, V,) hoolawe	14	35 H.
Ka latitu o Waioli	22	30 A.

(2) E holo ana kekahi ma ka moana i ka la 21 o Iune 1836, ma ka lon. 60° K. Nana aku la oia i ka la e moe ana i ka hema, me ka ohenanala, a he 40° 06′ ke kiekie o ka la. Heaha kona latitu?

⊙ Kiekie i ikea	40°	6′
Ka hooponopono ana	+	12
⊙ kiekie io	40	18
E hoolawe i ke kiekie io noloko mai o . . .	90	00
Ka loa kikowaenaoluna . . .	49	42 A.
Ka hioana o ka la . . .	+ 23	28 A.
O ka latitu	73	10 A.

(3) I ka la 14 o Aperila 1836, ma ka lonitu 140° Hi., ua anaia ka la i kona ku ana ma ka meridiana e moe ana i ka hema, he 60° 25′ kona kiekie. Heaha ka latitu?

Ka latitu 38° 44′ A.

(4) I ka la 15 o Mei 1836, ma ka meridiana o Ladana, ua anaia ke kiekie o ka la i kona ku ana ma ka meridiana ma ka acao akau, he 30° 6′ kona kiekie. Heaha ka latitu?

Ka latitu 40° 49′ He.

(5) I ke ku ana o ka la ma ka meridiana, e moe ana i ka hema, ua anaia kona kiekie 40° 20′, a o kona hio ana 9° 56′ A.; a he 26 kapuai ke kiekie o ka mea nana i ana maluna o ka hu naauli. Heaha kona latitu? Latitu 59° 26′ A.

MOKUNA XI.

O KA IMI ANA I KA HORA MA KA MOANA, A ME KA HOOPONOPONO ANA I KA WATI.

Okoa ko kanaka helu ana i na hora o ka la, okoa ko ka poe holoholomoku, a okoa hoi ko ka poe anahoku. Ua maheleia ka la e lakou a pau he 24 hora. Aka, ma *ko kanaka helu ana*, mai ke aumoe a hiki i ke aumoe he la ia, o na hora 12 mai ke aumoe a hiki i ke awakea, ua kapaia na hora kakahiaka: a o na hora 12 mai ke awakea a hiki i ke aumoe, ua kapaia na hora ahiahi. Ma ka helu ana o ka *poe anahoku*, ua hoomakaia ka la ma ke awakea, a helu lakou i na hora mai ka hora 1 a i ka 24 i kela awakea aku. A o ka *poe holoholomoku*, hoomaka lakou i ka helu ana ma ke awakea, he 12 hora nae mamua aku o ko kanaka la, a he 24 hora mamua aku o ko ka poe anahoku la; a ua kapaia na hora 12 mai ke awakea a hiki i ke aumoe na hora ahiahi; a o na hora 12 mai ke aumoe a i ke awakea, ua kapaia na hora kakahiaka.

Elua mau ano o ka manawa, o ka *manawa io* a me ka *manawa i ikea*. O ka *manawa io* oia no ka hora i ikea ma ka wati helepololei. O ka *manawa i ikea*, o ka hora ia i ikea ma ke kupono ana o ka la ma ke awakea. O ka holo kulike ole o ka honua ma ke alanui honua, oia ka mea e okoa

ai. Nolaila, i kekahi manawa, oi aku ka *manawa io* imua o ka *manawa i ikea*, a i kekahi manawa no hoi, oi aku ka *manawa i ikea* imua o ka *manawa io*; a ua kapaia keia oi ana *ka hoohalike ana o ka manawa*.

I ka imi ana i ka hora i ikea, e ana i ke kiekie o ka la me ka ohenanala ma ke kakahiaka paha i ka pii wikiwiki ana o ka la iluna, a ma ke ahiahi paha i ka iho wikiwiki ana o ka la ilalo. E houluulu pu me ia kiekie i 12 min. i mea e hooponopono ai no ka hapalua o ke anawaena, no ka paralake, a no ka hina ana o ka huinaaouli: a noloko olaila e hoolawe i ke Peluana, aia ma ka Papa Huhuihelu VIII, a koe no ke kiekie io. E hoomaopopo hoi i ka latitu o ka moku i ka wa e anaia'i ke kiekie o ka la. E lawe i ka hioana o ka la noloko mai o ka Alemanaka Holoholomoku paha, o ka Papa huhuihelu IV paha: a e hooponopono i keia hioana no ka lonitu o ka moku a me ka hora ma ka Papa huhuihelu V.

A'aila, o ka latitu a me ka hioana o ka la, ina ma ka akau laua a elua, a ina paha ma ka hema laua a elua, e hoolawe i ka hioana o ka la me 90 *deg. a koe no ka* LOAWELAU: *aka, ina ma ka akau kahi a ma ka hema kekahi, e houluulu pu i ka hioana a me* 90 *deg., oia no ka* LOAWELAU.

Aia i loaa ke kiekie o ka la a me ka lat. a me ka loawelau, alaila, e loaa koke ka hora i ikea. (E unuhi i na huhuihelu a pau noloko mai o ka Papa II.) E nana pono nae, ina *maluna* ke koo a me ke koookoa o ka huhuihelu e imi ai, *maluna* no hoi ka hoailona o ka hora o ke K paha o ka A paha: a ina *malalo* ke koo a me ke koookoa *malalo* no hoi ka hoailona o ka hora.

Penei ka imi ana.

E houluulu i ke kiekie o ka la, a me ka latitu, a me ka loawelau, no'oko mai o ka hapalua o keia houluulu ana e hoola ae i ke kiekie o ka la, a malama i ke koena. Alaila, e houluulu i neia mau Huhuihelu, ke kahaoki o ka latitu, ke kihi o'oko'i o ka loawelau, (e waiho ana no i ka 10 *okoa o ke a huhuihelu keia huhuihelu,) a me ke koo-okoa o ka hapalua o ka houluulu ana, a me ke koo o ke koena. Ma*

na koo e imi i ka hapalua o keia mau mea i houluuluia, a malaila ua kakauia ka hora e imi ai.

1 I ka la 10 o Okatoba 1836, i ka hora 8 a me na minute 21 o ka wati K. e holo ana kekahi moku ma ka latitu 51° 30′ A. a ma ka lon. 114° Hi., o ke kiekie o ka la 13° 32′. Heaha ka hora i ikea ma ia ana ana?

Ke kiekie o ka la i ikea	13° 32′	
Ka hooponopono ana no ka ½ o ke anawaena o ka la, ka paralake, a me ka hina ana o ke huinaaouli	+ 12′	
	13 44	
Ka hooponopono ana no ke peluana (Papa VIII)	— 4	
⊙ Kiekie io	13 40	
Ka Hioana o ka la ma Ladana Okatoba 10, 1836 ma ke awakea (Papa IV) . . .	6 44 H.	
Hooponopono ana no 114° lon. Hi. (Papa V)	— 7	
	6 37	
Ka hooponopono ana no na hora 3 a me na minute 39 mamua aku o ke awakea Okatoba 10 (Papa V)	— 3	
Hioana i ka hora e nana'i	6 34 H.	
E houluulu . .	90 00	
Ka loawelau	96 34 H.	

⊙ Kiekie . . .	13° 40′		
Latitu	51 30	Kahaoki	0.20585
Loawelau . . .	96 34	Kahaokiokoa . .	0.00286
Houluulu ana 2)	161 44		
½ Houluulu ana	80 52	Koookoa	9.20067
⊙ Kiekie . . .	13 40		
Koena	67 12	Koo	9.96467
			2)19.37405
8h. 7m. 9s. . . .		Koo	9.68702

Ma kahi i ku pono ai i keia huhuihelu, ua kakauia malaila ka hora kakahiaka . . . . . 8h. 7′ 9″
Ka hora ma ka wati 8 21 0

Oi aku ka wati 13 51

Nolaila, i ka la 10 o Okatoba i ka hora 8 7′ 9″ kakahiaka, oia ka manawa o keia ana ana.

2 I ka la 9 o Mei 1836 i ka hora 5h. 30′ ahiahi ma ka wati: ma ka latitu 39° 54′ A. a ma ka lonitu 17° 30′ Hi. ua anaia ke kiekie o ka la me ka ohenanala, he 15° 45′ kona kiekie. Heaha ka hora i ka wa e nana'i?

⊙ Kiekie i ikea . . . . . 15° 45′
Hooponopono ana . . . . . + 12

15 57
Hooponopono ana no ke peluana . . . . . — 3

⊙ Kiekie io 15 54

Ka hioana o ka la ma Ladana Mei 9 . 1836 awakea . . . . . } 17° 25′ 10″ A.
Hooponopono ana no 17° 30′ lon. Hi. . . — 48

17 24 22
Hooponopono ana no 5h. 30′ ahiahi . . . . + 3 44

⊙ Hioana Mei 9. 5h. 30m. ahiahi 17 28 06

Noloko o na degere . . . . . 90° 00′
E hoolawe i ka hioana o ka la 17 28

Koe ka loawelau 72 32

⊙ Kiekie	15° 54′		
Latitu	39 54	Kahaoki . . .	0.11511
Loawelau	72 32	Kahaokiokoa	0.02050
Houluulu ana	2)128 20		
½ Houluulu ana	64 10	Koookoa . . .	9.63924
⊙ Kiekie	15 54		
Ke koena	48 16	Koo	9.87288
			2)19.64773
	5h. 34m. 26s. A.	Koo .	9.82386
Ma ka wati	5 30		
Ua emi ka wati	4 26		

He mau ui.

1 Ma ka lat. 36° 39′ H. o ka hioana o ka la 9° 27′ A., a o ke kiekie o ka la i kakahiaka 10° 33′. Heaha ka hora i ikea?
Ka hora 7. 23m. 51s. Kakahiaka.

2 Ma ka lat. 36° 21′ H. o ka hioana o ka la 8° 44′ A.; a o ke kiekie o ka la 10° 48′ i kakahiaka. Heaha ka hora i ikea?
7h. 22m. 11s. Ka.

3 Ma ka lat. 29° 25′ A. o ka hioana o ka la 23° 20′ A. a o ke kiekie o ka la i ke ahiahi 14° 58′. Heaha ka hora i ikea?
5h. 41m. A.

4 Ma ka lat. 3° 31′ H. o ka hioana o ka la 20° 3′ He. a o ke kiekie o ka la 38° 41′ ma ke ahiahi. Heaha ka hora i ikea?
3h. 18m. 47s. A.

5 Ma ka lat. 13° 17′ A. o ka hioana o ka la 22° 10′ H.; a o ke kiekie o ka la i kakahiaka 36° 26′. Heaha ka hora i ikea?
9h. 17m. 8s. Ka.

6 Ma ka lat. 21° 36′ H.; o ka hioana o ka la 3° 37′ H. a o ke kiekie o ka la i ala i kakahiaka 35° 48′. Heaha ka hora i ikea?
8h. 29m. 50s. Ka.

MOKUNA XII.

O KA NANA MAHINA ANA

O ka hoomakaukau ana e imi i ka lon. ma ka nana mahina ana.

I ka manawa e anaia'i ka loa mawaena o ka la a me ka mahina, e imi i ka *hora i ikea*, ma ka helu ana mai ke awakea a i ke awakea, mai ka hora 1 a i ka hora 24: a e hoolawe i hookahi la noloko o ko ka poe holoholomoku helu ana. Me keia e hoopili pu mai ai i ka lonitu i hooliloia i hora: ina he komohana ka lonitu e hoeluulu pu; ina he hikina ka lonitu e hoolawe, a o ka hoeluulu ana, a o ke koena paha oia no ka manawa i ikea ma Ladana.

Iloko o ka Alemanaka Holoholomoku, ma ka aoao III o ka malama, e imi i ka *hapalua o ko ka mahina anawaena*, a me kona *Paralake huinaaouli* no ke awakea a me ke aumoe i pili mua, a i pili hope i ka manawa i ikea. E hoo-

maopopo i ka like ole o na hapalua o ke anawaena i ke awakea a me ke aumoe, a me ka like ole o na paralake; alaila, e komo i ka Papa huhuihelu VII, ma ka aoao ka like ole, maluna ka manawa i ikea, e ku pono ana ilaila ka hooponopono ana. He mea houluulu keia i ka hapalua anawaena a me ka paralake i kau mua ia ma ka Alemanaka ina e mahuahua ana laua, a he mea hoolawe ina e emi ana. A, me keia hapalua o ke anawaena e houluulu mai ai i ka *mahuahua ana* noloko mai o ka Papa XI e ku pono ana i ko ka mahina kiekie.

Aia ka hapalua anawaena o ka la ma ka aoao II o ka malama o ka Alemanaka Holoholomoku.

I ke ana ana i ke kiekie o ka la a me ka mahina; ina o ko lalo aoao ka i nanaia, e houluulu pu ilaila i 12 min.; aka, ina o ko luna aoao ka i nanaia, e hoolawe noloko olaila i 20 min.

I ke ana ana i ka loa mawaena o ka la a me ka mahina, e houluulu mai i ka hapalua o ko laua mau anawaena, oia ka *loa i ikea* mawaena o laua.

Penei ka hana ana.

1 E kakau mua i ka *paralake huinaaouli* o ka mahina, a malalo iho ona ke *kiekie o ka mahina*, a malalo iho ona *ke kiekie o ka la*, a malalo iho ka *loa i ikea* mawaena o ka la a me ka mahina. Alaila, e unuhi noloko o ka Papa huhuihelu XV i na minute a me na sekona, i mea e hooponopono ai i ka loa i ikea. Maluna o ka Papa e imi i ka *loa*, a ma ka aoao ke *kiekie nui* a me ke *kiekie uuku* ma ko laua mau papa iho, e ku pono ana malaila ka *hooponopono ana* ka mea e houluulu pu ai me ka loa i ikea: a e kapa aku i keia, o ka *Loa i hooponoponoia*.

2 Noloko o ka Papa huhuihelu XIV, e unuhi i ka huhuihelu hoohalike o ka paralake, a kakauia oia ma na papa elua. A e kakau iho i ke kahaokiokoa o ko ka mahina kiekie malalo iho o ka lua: a o ke kahaokiokoa o ko ka la kiekie malalo iho o ka mua; a o ke koo o ka loa i hooponoponoia malalo iho o ka mua, a o ke kahapili o ka loa i hooponoponoia malalo iho o ka lua. E houluulu i

keia mau papa (e kiola ana i ka 20 okoa) alaila, e imi i na huhuihelu ma ka Papa XIV, a malaila ua kakauia na pio elua.

Ina i oi aku ka pio mua i ka lua, e hoolawe i ka oi ana noloko mai o ka loa i hooponoponoia: aka, ina e oi aku ka lua o na pio i ka mua, e houluulu i ka oi ana me ka loa i hooponoponoia; a ina i oi aku ka loa i hooponoponoia i 90 deg., alaila, e hoolawe i ka houluulu ana o na pio elua noloko mai o ka loa i hooponoponoia, oia ka loa io.

Penei ka imi ana i ka lonitu.

E nana i ka Alemanaka Holoholomoku ma na aoao XIII, XIV, XV, XVI, XVII, XVIII, o ka malama, ina malaila ka loa io i loaa mai ai, alaila, aia maluna ka hora: aka, ina aole malaila keia loa, e lawe i ka loa nui iki ae, a me ka loa uuku iki iho, a e hoomaopopo i ka oi ana o kekahi i kekahi: a e hoomaopopo hoi i ka like ole o ka loa io a me ka loa i kau mua ia ma ka Alemanaka.

E unuhi i ka huhuihelu hoohalike o keia mau oi ana ma ka Papa XIV, a e hoolawe i ka huhuihelu mua noloko mai o ka lua, a koe no ka huhuihelu o kau wahi hora e ku ana ma ka Papa XIV. E houluulu pu i keia me ka hora e kau ana maluna o ka loa i lawe mua ia noloko o ka Alemanaka: a o ka houluulu ana, oia no ka *hora io ma Ladana.* O ka *like ole* o keia hora, a me ka *hora io* o ka moku, i hooliloia i degere ma ka Papa XIII, oia no ka *lonitu o ka moku.* Ina e oi aku ka hora o ka moku i ko Ladana, he lon. hikina ia; a ina e oi aku ka hora o Ladana i ko ka moku, he lonitu komohana ia.

I ka la 31 o Okatoba 1820 ma ko ka holoholomoku helu ana, i ke ahiahi; ma ka lonitu 75° paha komohana, ua anaia ka la a me ka mahina peneia. O ka loa i ikea mawaena o ka la a me ka mahina 68° 42′ 35″; o ke kiekie o ka la ko lalo aoao 45° 48′; o ke kiekie o ka mahina ko lalo aoao 16° 58′. Heaha ka lonitu o ka moku?

Ka loa i ikea	68°	42′	35″
☉ Hapalua anawaena		16	9
☽ Hapalua anawaena		14	53
Ka loa io i ikea	69	13	37

⊙ Kiekie	45° 48′	☽ Kiekie	16° 58′
Ka hooponopono ana	12′	Ka hooponopono ana	12
⊙ Kiekie io	46° 00′	☽ Kiekie io	17° 10′

Ma ke kiekie o ka la, e like me ka hana ana i hoakakaia mai mamua, ua loaa ka hora 1h. 0m. 4s. o ke ahiahi.

Ma ko ka holoholomoku helu ana Okatoba 31l. 1h. 0m. 4s.
E hoolawe i hookahi la 1

Koe ko ka poe Anahoku helu ana 30 1 0 4

E imi i ka loa io penei;

☽ Paralake Huinaaouli	0° 54′ 17″	Huhuihelu hoohalike	5206	Huhuihelu hoohalike	5206
☽ Kiekie . .	17 10 00			Kahaokiokoa	5299
⊙ Kiekie . .	46 00 00	Kahaokiokoa	1430		
Loa i ikea. .	69 13 37				
Ka hooponopono mua . .	+ 2 27				
Ka loa i hooponoponoia	69 16 04	Koo . . .	9.9709	Kahapili . .	.4219
Ka hooponopono lua . . .	— 35 41	H. H.	6345	H. H.	1.4724
Ka loa io . .	68 40 23	Pio mua . . .	41′ 45′		
		Pio lua . . .	6 4		
		Ka hooponopono lua	35 41		

Ka loa io	68° 40′ 23″			
Alemanaka Holoholomoku i ka hora 6	68 40 28	Ka oi ana	0° 0′ 6″	3.2553
Alemanaka Holoholomoku i ka hora 9	67 19 11	Ka oi ana	1 21 18	0.3452
			0h. 0′ 13″	2.9101
		Houluulu	6	
Ka hora io ma Ladana			6 0 13	
Ka hora io ma ka moku			1 0 4	
O ka like ole			5 0 9	

E hoolilo i keia i degere = 75° 2′ komohana, oia ka lonitu o ka moku.

(2) I ka makahiki 1834 i ka la 5 o Feberuari ma ko ka moku helu ana, i ka hora 8, a me na minute 36 kakahiaka, ma ka lon. 21° 30′ K. paha, aole akaka loa, ua anaia ka la a me ka mahina penei; o ka

loa i ikea mawaena o ka la a me ka mahina 36° 25′ 36″; o ke kiekie o ka la, ko lalo aoao, 34° 28′; o ke kiekie o ka mahina, ko luna aoao, 61° 20′. Heaha ka lonitu o ka moku?

Ma ko ka moku helu ana Feb. 5, oia ma ka Alemanaka Holoholomoku Feb.	4la 20h. 36′
Lonitu 21° 30′ K.	1 26
Hora ma Ladana Feb.	4la 22h. 2m.

Penei ka imi ana i ka hapalua o ka mahina a me ka paralake.

☽ ½ anawaena, Alemanaka, Feb. 4 aumoe . .	15′ 15″	☽ Par. Feb. 4 aumoe	55′ 59″
Feb. 5 awakea	15 11	Feb. 5 awakea	55 45
Like ole	4	Like ole	14
Papa VII	— 3	Papa VII	— 12
	15 12	☽ Paralake	55 47
Mahuahua, Papa XI .	+ 14		
☽ ½ anawaena	15 26		

Ka loa i ikea	36° 25′ 36″
⊙ Hapalua anawaena (A. H.)	16 14
☽ Hapalua anawaena	15 26
Ka loa io i ikea	36 57 16

⊙ Kiekie i ikea	34° 28′	☽ Kiekie ko luna aoao	61° 20′
	+ 12		— 20
⊙ Kiekie io . .	34 40	☽ Kiekie io	61 00

Penei ka imi ana i ka loa io mawaena o ka la a me ka mahina.

☽ Paralake	55′ 47″	Papa XIV 5088		Papa XIV 5088	
☽ Kiekie	61° 0 0			Kah. okoa 0582	
⊙ Kiekie	34 40 0	Kah. okoa 2450			
Loa io i ikea	36 57 16				
Ka hooponopono mua	+ 54				
Ka loa i hooponoponoia	36 58 10	Koo . . .	9.7791	Kahapili	9.8766
	+ 12 3				
			0.5329		0.4436
Loa io	37 10 13	Pio mua	53′ 46″		
		Pio lua	1° 4 49		
		Ka hooponopono lua	12 03		

Penei ka imi ana i ka lonitu.

Ka loa io . . . . . 37° 10′ 13″
Feb. 4 21h. (A. H.) 37 40 35

Ka like ole . . . . . 30 22 Papa XIV . . 7729
Feb. 4 21h. (A. H.) 37° 40′ 35″
Feb. 5 0h. (A. H.) 36 14 0

Ka like ole . . . . . 1 26 35 Papa XIV . . 3178

1h. 3′ 7″ 4551
+ 21

Hora ma Ladana 22 3 7
Hora ma ka moku 20 36 0

Ka like ole o ka manawa 1 27 7 (Pap. XIII) = 21° 47′ lon. K.

(3) I ka makahiki 1820 Ian. 2 la 12 hora 6 minute aumoe ma ko ka moku helu ana, ma ka lonitu 121° 30′ paha; ua anaia ka loa mawaena o ka mahina, ka aoao mawaho, a me kekahi hoku nui o Aldebarana 47° 48′ 53″. O ke kiekie o ka hoku 50° 35′, a o ke kiekie o ka mahina 70° 25′. Heaha ka lonitu?

Ma ko ka moku helu ana Ian. 2, oia ma ko ka Alemanaka Holoholomoku Ian. . . . . 1 la 12h. 6′
Lon. 121° 30′ Hi. . . 8 6

Hora ma Ladana Ian. 1 4 0

☽ ½ anawaena Ian. 1, awakea (A. H.) 14′ 51″
" " " aumoe (A. H.) 14 59
☽ Par. Huinaaouli Ian. 1, awakea (A. H.) 54′ 25″
" " " aumoe (A. H.) 54 17

✳ Kiekie i ikea 50° 35′ ☽ Kiekie i ikea 70° 35′
Hina ana o ka huinaaouli — 4 + 12

✳ Kiekie io . . . . . 50 31 ☽ Kiekie io . . . 70 47

Ka loa i ikea 47° 48′ 53″ Ka loa ma ka A. H. 3h. 46° 56′ 11″
☽ ½ anawaena — 15 5 " " 6h. 48 23 59

Ka loa io i ikea 47 33 48

Ka lonitu 121° 45½′ Hikina.

MOKUNA XIII.

O KA IMI ANA I KA LONITU MA KA WATI HELE POLOLEI LOA.

Ma ka wati, ua hoikeia mai ka hora ma Ladana: a ma ke ana ana i ke kiekie o ka la ua loaa ka hora ma ka moku. O ka like ole o ka hora ma ka moku a me ka hora ma Ladana a ka wati i hoike mai ai, i hooliloia i degere, o ka lonitu no ia o ka moku.

I ka la 27 o Iulai 1820, ua loaa ka hora i ikea ma ke ana ana i ke kiekie o ka la, 1 hora 5m. 8s. ahiahi: ilaila ua ikea ma ka wati ka hora ma Ladana 4 hora 3m. 8s. ahiahi. Heaha ka lonitu o ka moku?

Ka hora i ikea	1h.	5′	8″
Ka hoohalike ana o ka manawa e unuhiia noloko mai o ka Alemanaka Holoholomoku aoao II o ka malama.	+	6	8
Ka hora io o ka moku	1	11	16
Ka hora ma Ladana	4	3	8
Ka like ole	2	51	52

O keia like ole i hooliloia i degere ma ka Papa XIII, oia no ka lonitu komohana, no ka oi ana o ka hora ma Ladana = 42° 58′ lon. K.

☉ Kiekie	45° 48′	☽ Kiekie	16° 58′
Ka hooponopono ana	12′	Ka hooponopono ana	12
☉ Kiekie io	46° 00′	☽ Kiekie io	17° 10′

Ma ke kiekie o ka la, e like me ka hana ana i hoakakaia mai mamua, ua loaa ka hora 1h. 0m. 4s. o ke ahiahi.

Ma ko ka holoholomoku helu ana Okatoba 31l. 1h. 0m. 4s.
E hoolawe i hookahi la 1

Koe ko ka poe Anahoku helu ana 30 1 0 4

E imi i ka loa io penei;

☽ Paralake Huinaaouli	0° 54′ 17″	Huhuihelu hoohalike	5206	Huhuihelu hoohalike	5206
☽ Kiekie . .	17 10 00			Kahaokiokoa	5299
☉ Kiekie . .	46 00 00	Kahaokiokoa	1430		
Loa i ikea. .	69 13 37				
Ka hooponopono mua . .	+ 2 27				
Ka loa i hooponoponoia	69 16 04	Koo . . .	9.9709	Kahapili . . .	.4219
Ka hooponopono lua . . .	— 35 41	H. H.	6345	H. H.	1.4724
Ka loa io . .	68 40 23	Pio mua . . .	41′ 45′		
		Pio lua	6 4		
		Ka hooponopono lua	35 41		

Ka loa io	68° 40′ 23″			
Alemanaka Holoholomoku i ka hora 6	68 40 28	Ka oi ana	0° 0′ 6″	3.2553
Alemanaka Holoholomoku i ka hora 9	67 19 11	Ka oi ana	1 21 18	0.3452
			0h. 0′ 13″	2.9101
		Houluulu	6	
Ka hora io ma Ladana			6 0 13	
Ka hora io ma ka moku			1 0 4	
O ka like ole			5 0 9	

E hoolilo i keia i degere = 75° 2′ komohana, oia ka lonitu o ka moku.

(2) I ka makahiki 1834 i ka la 5 o Feberuari ma ko ka moku helu ana, i ka hora 8, a me na minute 36 kakahiaka, ma ka lon. 21° 30′ K. paha, aole akaka loa, ua anaia ka la a me ka mahina penei; o ka

loa i ikea mawaena o ka la a me ka mahina 36° 25′ 36″; o ke kiekie o ka la, ko lalo aoao, 34° 28′; o ke kiekie o ka mahina, ko luna aoao, 61° 20′. Heaha ka lonitu o ka moku?

Ma ko ka moku holu ana Feb. 5, oia ma ka Alemanaka a ka Holoholomoku Feb. } 4la 20h. 36′
Lonitu 21° 30′ K. 1 26

Hora ma Ladana Feb. . . . . 4la 22h. 2m.

Penei ka imi ana i ka hapalua o ka mahina a me ka paralake.

☽ ½ anawaena, Alemanaka, Feb. 4 aumoe . . } 15′ 15″ ☽ Par. Feb. 4 aumoe 55′ 59″
Feb. 5 awakea . . . . 15 11 Feb. 5 awakea 55 45

Like ole 4 Like ole 14
Papa VII . . . . . — 3 Papa VII . . . . — 12

15 12 ☽ Paralake 55 47
Mahuahua, Papa XI . + 14

☽ ½ anawaena 15 26

Ka loa i ikea . . . . . 36° 25′ 36″
⊙ Hapalua anawaena (A. H.) 16 14
☽ Hapalua anawaena 15 26

Ka loa io i ikea 36 57 16

⊙ Kiekie i ikea 34° 28′ ☽ Kiekie ko luna aoao 61° 20′
+ 12 — 20

⊙ Kiekie io . . 34 40 ☽ Kiekie io 61 00

Penei ka imi ana i ka loa io mawaena o ka la a me ka mahina.

☽ Paralake . . . . . 55′ 47″ Papa XIV 5088 Papa XIV 5088
☽ Kiekie . . . . . 61° 0 0 Kah. okoa 0582
⊙ Kiekie . . . . . 34 40 0 Kah. okoa 2450
Loa io i ikea 36 57 16
Ka hooponopono mua + 54

Ka loa i hooponoponoia 36 58 10 Koo . . . 9.7791 Kahapili 9.8766
+ 12 3 0.5329 0.4436

Loa io . . . . . 37 10 13 Pio mua 53′ 46″
Pio lua 1° 4 49

Ka hooponopono lua 12 03

Penei ka imi ana i ka lonitu.

Ka loa io . . . . . 37° 10′ 13″
Feb. 4 21h. (A. H.) 37 40 35

Ka like ole . . . . . 30 22 Papa XIV . . 7729
Feb. 4 21h. (A. H.) 37° 40′ 35″
Feb. 5 0h. (A. H.) 36 14 0

Ka like ole . . . . . 1 26 35 Papa XIV . . 3178

1h. 3′ 7″ 4551
+21

Hora ma Ladana 22 3 7
Hora ma ka moku 20 36 0

Ka like ole o ka manawa 1 27 7 (Pap. XIII) = 21° 47′ lon. K.

(3) I ka makahiki 1820 Ian. 2 la 12 hora 6 minute aumoe ma ko ka moku helu ana, ma ka lonitu 121° 30′ paha; ua anaia ka loa mawaena o ka mahina, ka aoao mawaho, a me kekahi hoku nui o Aledebarana 47° 48′ 53″. O ke kiekie o ka hoku 50° 35′, a o ke kiekie o ka mahina 70° 25′. Heaha ka lonitu?

Ma ko ka moku helu ana Ian. 2, oia ma ko ka Alemanaka Holoholomoku Ian. . . . . 1 la 12h. 6′
Lon. 121° 30′ Hi. . . 8 6

Hora ma Ladana Ian. 1 4 0

☽ ½ anawaena Ian. 1, awakea (A. H.) 14′ 51″
" " " aumoe (A. H.) 14 59
☽ Par. Huinaaouli Ian. 1, awakea (A. H.) 54′ 25″
" " " aumoe (A. H.) 54 17

☀ Kiekie i ikea 50° 35′ ☽ Kiekie i ikea 70° 35′
Hina ana o ka huinaaouli — 4 + 12

☀ Kiekie io . . . . . 50 31 ☽ Kiekie io . . . 70 47

Ka loa i ikea 47° 48′ 53″ Ka loa ma ka A. H. 3h. 46° 56′ 11″
☽ ½ anawaena — 15 5 " " 6h. 48 23 59

Ka loa io i ikea 47 33 48

Ka lonitu 121° 45½′ Hikina.

MOKUNA XIII.

O KA IMI ANA I KA LONITU MA KA WATI HELE POLOLEI LOA.

Ma ka wati, ua hoikeia mai ka hora ma Ladana: a ma ke ana ana i ke kiekie o ka la ua loaa ka hora ma ka moku. O ka like ole o ka hora ma ka moku a me ka hora ma Ladana a ka wati i hoike mai ai, i hooliloia i degere, o ka lonitu no ia o ka moku.

I ka la 27 o Iulai 1820, ua loaa ka hora i ikea ma ke ana ana i ke kiekie o ka la, 1 hora 5m. 8s. ahiahi: ilaila ua ikea ma ka wati ka hora ma Ladana 4 hora 3m. 8s. ahiahi. Heaha ka lonitu o ka moku?

Ka hora i ikea	1h.	5′	8″
Ka hoohalike ana o ka manawa e unuhiia noloko mai o ka Alemanaka Holoholomoku aoao II o ka malama.	+	6	8
Ka hora io o ka moku	1	11	16
Ka hora ma Ladana	4	3	8
Ka like ole	2	51	52

O keia like ole i hooliloia i degere ma ka Papa XIII, oia no ka lonitu komohana, no ka oi ana o ka hora ma Ladana = 42° 58′ lon. K.

Loa.	0 deg. 15 min.		0 deg. 30 min.		0 deg. 45 min.		Loa.
	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	
1	1.00	0.00	1.00	0.01	1.00	0.01	1
2	2.00	0.01	2.00	0.02	2.00	0.03	2
3	3.00	0.01	3.00	0.03	3.00	0.04	3
4	4.00	0.02	4.00	0.03	4.00	0.05	4
5	5.00	0.02	5.00	0.04	5.00	0.07	5
6	6.00	0.03	6.00	0.05	6.00	0.08	6
7	7.00	0.03	7.00	0.06	7.00	0.09	7
8	8.00	0.03	8.00	0.07	8.00	0.10	8
9	9.00	0.04	9.00	0.08	9.00	0.12	9
10	10.00	0.04	10.00	0.09	10.00	0.13	10
11	11.00	0.05	11.00	0.10	11 00	0.14	11
12	12.00	0.05	12.00	0.10	12.00	0.16	12
13	13.00	0.06	13.00	0.11	13.00	0.17	13
14	14.00	0.06	14.00	0.12	14.00	0.18	14
15	15.00	0.07	15.00	0.13	15.00	0.20	15
16	16.00	0.07	16.00	0.14	16.00	0.21	16
17	17.00	0.07	17 00	0.15	17.00	0.22	17
18	18.00	0.08	18.00	0.16	18.00	0.24	18
19	19.00	0.08	19.00	0.17	19.00	0.25	19
20	20.00	0.09	20.00	0.17	20.00	0.26	20
21	21.00	0.09	21.00	0.18	21.00	0.27	21
22	22.00	0.10	22.00	0.19	22.00	0.29	22
23	23.00	0.10	23.00	0.20	23.00	0.30	23
24	24.00	0.10	24.00	0.21	24.00	0.31	24
25	25.00	0.11	25.00	0.22	25.00	0.33	25
26	26.00	0.11	26.00	0.23	26.00	0.34	26
27	27.00	0.12	27.00	0.24	27.00	0.35	27
28	28.00	0.12	28.00	0.24	28.00	0.37	28
29	29.00	0.13	29.00	0.25	29.00	0.38	29
30	30.00	0.13	30.00	0.26	30 00	0.39	30
31	31.00	0.14	31.00	0.27	31.00	0.41	31
32	32.00	0.14	32.00	0.28	32.00	0.42	32
33	33.00	0.14	33.00	0 29	33.00	0.43	33
34	34.00	0.15	34.00	0.30	34.00	0.45	34
35	35.00	0.15	35.00	0.31	35.00	0.46	35
36	36.00	0.16	36.00	0.31	36 00	0.47	36
37	37.00	0.16	37.00	0.32	37.00	0.48	37
38	38.00	0.17	38.00	0.33	38.00	0.50	38
39	39.00	0.17	39.00	0.34	39.00	0.51	39
40	40.00	0.17	40.00	0.35	40.00	0.52	40
41	41.00	0.18	41.00	0.36	41.00	0.54	41
42	42.00	0.18	42.00	0.37	42.00	0.55	42
43	43.00	0.19	43.00	0 38	43.00	0.56	43
44	44.00	0.19	44.00	0.38	44.00	0.58	44
45	45.00	0.20	45.00	0.39	45.00	0.59	45
46	46.00	0.20	46.00	0.40	46.00	0.60	46
47	47.00	0.20	47.00	0.41	47.00	0.62	47
48	48.00	0.21	48.00	0.42	48.00	0.63	48
49	49.00	0.21	49.00	0.43	49.00	0.64	49
50	50.00	0.22	50.00	0.44	50.00	0.65	50
Loa.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Loa.
	89 deg.	15 min.	89 deg.	30 min.	89 deg.	15 min.	

Loa.	1 deg. 0 min.		1 deg. 15 min.		1 deg 30 min.		1 deg. 45 min.		Loa.
	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	
1	1.00	0.02	1.00	0.02	1.00	0.03	1.00	0.03	1
2	2.00	0.03	2.00	0.04	2.00	0.05	2.00	0.06	2
3	3.00	0.05	3.00	0.07	3.00	0.08	3.00	0.09	3
4	4.00	0.07	4·00	0.09	4.00	0.10	4.00	0.12	4
5	5.00	0.09	5.00	0.11	5.00	0.13	5.00	0.15	5
6	6.00	0.10	6.00	0.13	6.00	0.16	6.00	0.18	6
7	7.00	0.12	7.00	0.15	7.00	0.18	7.00	0 21	7
8	8.00	0.14	8.00	0.17	8.00	0.21	8.00	0.24	8
9	9.00	0.16	9.00	0.20	9.00	0.24	9.00	0.27	9
10	10.00	0.17	10.00	0.22	10.00	0.26	10.00	0.31	10
11	11.00	0.19	11.00	0.24	11.00	0.29	10.99	0.34	11
12	12.00	0.21	12.00	0.26	12.00	0.31	11.99	0.37	12
13	13.00	0.23	13.00	0.28	13 00	0.34	12.99	0 40	13
14	14.00	0.24	14.00	0.31	14.00	0.37	13.99	0.43	14
15	15.00	0.26	15.00	0.33	15.00	0.39	14.99	0.46	15
16	16.00	0.28	16.00	0.35	15.99	0.42	15.99	0.49	16
17	17.00	0.30	17.00	0.37	16.99	0.45	16.99	0.52	17
18	18.00	0.31	18.00	0.39	17.99	0 47	17.99	0.55	18
19	19 00	0.33	19.00	0.41	18.99	0.50	18 99	0.58	19
20	20.00	0.35	20.00	0.44	19.99	0.52	19.99	0.61	20
21	21.00	0.37	21.00	0.46	20.99	0.55	20.99	0.64	21
22	22.00	0.38	21.99	0.48	21.99	0.58	21.99	0.67	22
23	23.00	0.40	22.99	0.50	22.99	0 60	22.99	0.70	23
24	24.00	0.42	23.99	0.52	23.99	0.63	23.99	0.73	24
25	25.00	0.44	24.99	0.55	24.99	0.65	24.99	0.76	25
26	26.00	0.45	25.99	0.57	25.99	0.68	25.99	0 79	26
27	27.00	0 47	26.99	0.59	26 99	0.71	26.99	0.82	27
28	28.00	0.49	27.99	0.61	27.99	0.73	27.99	0.86	28
29	29.00	0.51	28.99	0.63	28 99	0.76	28.99	0.89	29
30	30.00	0.52	29.99	0.65	29.99	0.79	29.99	0.92	30
31	31.00	0.54	30.99	0.68	30.99	0.81	30.99	0.95	31
32	32.00	0.56	31.99	0.70	31.99	0.84	31.99	0.98	32
33	33.00	0.58	32.99	0 72	32.99	0.86	32.98	1.01	33
34	33.99	0.59	33.99	0.74	33.99	0.89	33.98	1.04	34
35	34.99	0.61	34 99	0.76	34.99	0.92	34.98	1.07	35
36	35.99	0.63	35.99	0.79	35.99	0.94	35.98	1.10	36
37	36.99	0.65	36.99	0.81	36.99	0.97	26 98	1.13	37
38	37.99	0.66	37.99	0.83	37.99	0.99	37.98	1.16	38
39	38.99	0.68	28.99	0.85	38.99	1.02	38.98	1.19	39
40	39.99	0.70	39.99	0.87	39.99	1.05	39.98	1.22	40
41	40.99	0 72	40.99	0.89	40.99	1.07	40.98	1.25	41
42	41.99	0.73	41.99	0.92	41.99	1.10	41.98	1.28	42
43	42.99	0.75	42.99	0.94	42.99	1.13	42.98	1.31	43
44	43.99	0.77	43.99	0.96	43.99	1.15	43.98	1.34	44
45	44.99	0.79	44.99	0.98	44.98	1.18	44.92	1.37	45
46	45.99	0.80	45.99	1.00	45.98	1.20	45.98	1.40	46
47	46.99	0.82	46.99	1.03	46.98	1.23	46.98	1.44	47
48	47.99	0.84	47.99	1.05	47.98	1.26	47.98	1.47	48
49	48.99	0.86	48.99	1.07	48.98	1.28	48.98	1.50	49
50	49.99	0.87	49.99	1.09	49.98	1.31	49.98	1.53	50
Loa.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Loa.
	49 deg.	00 min.	88 deg.	45 min.	88 deg.	30 min.	88 deg.	15 min.	

Loa.	2 deg. 0 min.		2 deg. 15 min.		2 deg. 30 min		2 deg. 45 min.		Loa.
	Lat.	Lon.	Lat	Lon.	Lat.	Lon.	Lat.	Lon.	
1	1.00	0.03	1.00	0.04	1.00	0.04	1.00	0.05	1
2	2.00	0.07	2.00	0.08	2.00	0.09	2.00	0.10	2
3	3.00	0.10	3.00	0.12	3.00	0.13	3.00	0.14	3
4	4.00	0.14	4.00	0 16	4.00	0.17	4.00	0.19	4
5	5.00	0.17	5.00	0.20	5.00	0.22	4.99	0.24	5
6	6.00	0.21	6.00	0.24	5.99	0.26	5.99	0.29	6
7	7 00	0.24	6.99	0.27	6.99	0.31	6.99	0 34	7
8	7.00	0.28	7.99	0.31	7 99	0.35	7.99	0.38	8
9	8.99	0.31	8.99	0.35	8.99	0.39	8 99	0.43	9
10	9.99	0.35	9.99	0.39	9.99	0.44	9.99	0.48	10
11	10.99	0.38	10 99	0.43	10.99	0.48	10.99	0.53	11
12	11.99	0.42	11.99	0.47	11.99	0.52	11.99	0.58	12
13	12.99	0.45	12.99	0.51	12.99	0.57	12.99	0.62	13
14	13.99	0.49	13.99	0.55	13.99	0.61	13.98	0.67	14
15	14.99	0.52	14.99	0.59	14.99	0.65	14.98	0.72	15
16	15.99	0.56	15 99	0.63	15.98	0.70	15.98	0.77	16
17	16.99	0 59	16.99	0.67	16.98	0.74	16.98	0.82	17
18	17.99	0.63	17.99	0.71	17.98	0.79	17 98	0 86	18
19	18.99	0.66	18.99	0.75	18.98	0.83	18 98	0.91	19
20	19.99	0.70	19.98	0.79	19.98	0.87	19 98	0 96	20
21	20.99	0.73	20.98	0.82	20.98	0.92	20.98	1.01	21
22	21.99	0.77	21.98	0.86	21.98	0.96	21.97	1.06	22
23	22.99	0.80	22.98	0.90	22.98	1.00	22.97	1.10	23
24	23.99	0.84	23.98	0.94	23.98	1.05	23.97	1.15	24
25	24.98	0.87	24.98	0.98	24.98	1.09	24.97	1.20	25
26	25.98	0.91	25.98	1.02	25.98	1.13	25.97	1.25	26
27	26 98	0.94	26.98	1.06	26.97	1.18	26.97	1.30	27
28	27.98	0.98	27.98	1.10	27.97	1.22	27.97	1.34	28
29	28.98	1.01	28.98	1.14	28.97	1.27	28.97	1.39	29
30	29.98	1.05	29.98	1.18	29.97	1.31	29.97	1.44	30
31	30.98	1.08	30.98	1.22	30.97	1.35	30.96	1.49	31
32	31.98	1.12	31.98	1.26	31.97	1.40	31.96	1.54	32
33	32.98	1.15	32.97	1.30	32.97	1.44	32.96	1.58	33
34	33.98	1.19	33.97	1.33	33.97	1.48	33.96	1.63	34
35	34.98	1.22	34.97	1.37	34.97	1.53	34.96	1.68	35
36	35.98	1.26	35.97	1.41	35.97	1.57	35.96	1.73	36
37	36 98	1.29	36.97	1.45	36.96	1.61	36.96	1.78	37
38	37.98	1.33	37.97	1.49	37.96	1.66	37.96	1.82	38
39	38.98	1 36	38.97	1.53	38.96	1.70	38.96	1.87	39
40	39.98	1.40	39.97	1.57	39.96	1.74	39.95	1.92	40
41	40.98	1.43	40.97	1.61	40.96	1.79	40.95	1.97	41
42	41.97	1.47	41.97	1.65	41.96	1.83	41.95	2.02	42
43	42.97	1.50	42.97	1.69	42.96	1.88	42.95	2.06	43
44	43.97	1.54	43.97	1.73	43.96	1.92	43.95	2.11	44
45	44.97	1.57	44.97	1.77	44.96	1.96	44.95	2.16	45
46	45.97	1.61	45.96	1.81	45.96	2.01	45.95	2.21	46
47	46.97	1.64	46.96	1 85	46.96	2.05	46.95	2.26	47
48	47.97	1.68	47 96	1.88	47.95	2.09	47.94	2.30	48
49	48.97	1.71	48.96	1.92	48.95	2.14	48.94	2.35	49
50	49.97	1.75	49 96	1.96	49.95	2.18	49.94	2.40	50
Loa.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Loa.
	89 deg.	0 min.	87 deg.	45 min.	87 deg.	30 min.	87 deg.	15 min.	

Loa.	3 deg. 0 min.		3 deg. 15 min.		3 deg. 30 min.		3 deg. 45 min.		Loa.
	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	
1	1.00	0.05	1.00	0.06	1.00	0.06	1.00	0.07	1
2	2.00	0.10	2.00	0.11	2.00	0.12	2.00	0.13	2
3	3.00	0.16	3.00	0.17	2.99	0.18	2.99	0.20	3
4	3.99	0.21	3.99	0.23	3.99	0.24	3.99	0.26	4
5	4.99	0.26	4.99	0.28	4.99	0.31	4.99	0.33	5
6	5.99	0.31	5.99	0.34	5.99	0.37	5.99	0.39	6
7	6.99	0.37	6.99	0.40	6.99	0.43	6.99	0.46	7
8	7.99	0.42	7.99	0.45	7.99	0.49	7.98	0.52	8
9	8.99	0.47	8.99	0.51	8.98	0.55	8.98	0.59	9
10	9.99	0.52	9.98	0.57	9.98	0.61	9.98	0.65	10
11	10.98	0.58	10.98	0.62	10.98	0.67	10.98	0.72	11
12	11.98	0.63	11.98	0.68	11.98	0.73	11.97	0.78	12
13	12.98	0.68	12.98	0.74	12.98	0.79	12.97	0.85	13
14	13.98	0.73	13.98	0.79	13.97	0.85	13.97	0.92	14
15	14.98	0.79	14.98	0.85	14.97	0.92	14.97	0.98	15
16	15.98	0.84	15.97	0.91	15.97	0.98	15.97	1.05	16
17	16.98	0.89	16.97	0.96	16.97	1.04	16.96	1.11	17
18	17.98	0.94	17.97	1.02	17.97	1.10	17.96	1.18	18
19	18.97	0.99	18.97	1.08	18.96	1.16	18.96	1.24	19
20	19.97	0.05	19.97	1.13	19.96	1.22	19.96	1.31	20
21	20.97	1.10	20.97	1.19	20.96	1.28	20.96	1.37	21
22	21.97	1.15	21.96	1.25	21.96	1.34	21.95	1.44	22
23	22.97	1.20	22.96	1.30	22.96	1.40	22.95	1.50	23
24	23.97	1.26	23.96	1.36	23.96	1.47	23.95	1.57	24
25	24.97	1.31	24.95	1.42	24.95	1.53	24.95	1.64	25
26	25.96	1.36	25.95	1.47	25.95	1.59	25.94	1.70	26
27	26.96	1.41	26.95	1.53	26.95	1.65	26.94	1.77	27
28	27.96	1.47	27.95	1.59	27.95	1.71	27.94	1.83	28
29	28.96	1.52	28.95	1.64	28.95	1.77	28.94	1.90	29
30	29.96	1.57	29.95	1.70	29.94	1.83	29.94	1.96	30
31	30.96	1.62	30.95	1.76	30.94	1.89	30.93	2.03	31
32	31.96	1.67	31.95	1.81	31.94	1.95	31.93	2.09	32
33	32.95	1.73	32.95	1.87	32.94	2.01	32.93	2.16	33
34	33.95	1.78	33.95	1.93	33.94	2.08	33.93	2.22	34
35	34.95	1.83	34.94	1.98	34.93	2.14	34.93	2.29	35
36	35.95	1.88	35.94	2.04	35.93	2.20	35.92	2.25	36
37	36.95	1.94	36.94	2.10	36.93	2.26	36.92	2.22	37
38	37.95	1.99	37.94	2.15	37.93	2.32	37.92	2.29	38
39	38.95	2.04	38.94	2.21	38.93	2.38	38.92	2.25	39
40	39.95	2.09	39.94	2.27	39.93	2.44	39.91	2.62	40
41	40.94	2.15	40.93	2.32	40.92	2.50	40.91	2.68	41
42	41.94	2.20	41.93	2.38	41.92	2.56	41.91	2.75	42
43	42.94	2.25	42.93	2.44	42.92	2.63	42.91	2.81	43
44	43.94	2.30	43.93	2.49	43.92	2.69	43.91	2.88	44
45	44.94	2.36	44.93	2.55	44.92	2.75	44.90	2.94	45
46	45.94	2.41	45.93	2.61	45.91	2.81	45.90	3.01	46
47	46.94	2.46	46.92	2.66	46.91	2.87	46.90	3.07	47
48	47.93	2.51	47.92	2.72	47.91	2.93	47.90	3.14	48
49	48.93	2.56	48.92	2.78	48.91	2.99	48.90	3.20	49
50	49.93	2.62	49.92	2.83	49.91	3.05	49.89	3.27	50
Loa.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Loa.
	87 deg.	0 min.	86 deg.	45 min.	86 deg.	30 min.	86 deg.	15 min.	

Loa.	4 deg. 0 min.		4 deg. 15 min.		4 deg 30 min.		4 deg. 45 min.		Loa.
	Lat	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	
1	1.00	0.07	1.00	0.07	1.00	0.08	1.00	0.08	1
2	2.00	0.14	1.99	0.15	1 99	0.16	1.99	0.17	2
3	2.99	0.21	2.99	0.22	2.99	0.24	2.99	0.25	3
4	3.99	0.28	3.99	0.30	3.99	0.31	3.99	0.33	4
5	4.99	0.35	4.99	0.37	4.98	0.39	4.98	0.41	5
6	5.99	0.42	5.98	0.44	5.98	0.47	5.98	0.50	6
7	6.98	0.49	6.98	0.52	6.98	0.55	6.98	0.58	7
8	7.98	0.56	7.98	0.59	7.98	0.63	7.97	0 66	8
9	8.98	0.63	8.98	0.67	8.97	0.71	8.97	0.75	9
10	9.98	0.70	9.97	0.74	9.97	0.78	9.97	0.83	10
11	10.97	0.77	10.97	0.82	10.97	0.86	10.96	0.91	11
12	11.97	0.84	11.97	0.89	11.96	0.94	11.96	0.99	12
13	12.97	0.91	12.96	0.96	12.96	1.02	12.96	1.08	13
14	13.97	0.98	13.96	1.04	13.96	1.10	13.95	1.16	14
15	14.96	1.05	14.96	1.11	14.95	1.18	14.95	1.24	15
16	15.96	1.12	15.96	1.19	15.95	1.26	15.95	1.33	16
17	16.96	1.19	16.95	1.26	16.95	1 33	16.94	1.41	17
18	17.96	1.26	17.95	1.33	17.94	1.41	17.94	1.49	18
19	18.95	1.33	18.95	1.41	18.94	1.49	18.93	1.57	19
20	19.95	1.40	19.95	1.48	19.94	1.57	19.93	1.66	20
21	20.95	1.47	20.94	1.56	20.94	1.65	20.93	1.74	21
22	21.95	1.53	21 94	1.63	21.93	1.73	21.92	1.82	22
23	22.94	1.60	22 94	1.70	22.93	1.80	22.92	1.90	23
24	23.94	1.67	23.93	1.78	23.93	1.88	23 92	1.99	24
25	24.94	1.74	24.93	1.85	24.92	1.96	24.91	2.07	25
26	25.94	1.81	25.93	1.93	25.92	2.04	25.91	2.15	26
27	26.93	1.88	26.93	2.00	26.92	2.12	26.91	2.24	27
28	27.93	1.95	27.92	2.08	27.91	2.20	27.90	2.32	28
29	28.93	2.02	28.92	2.15	28.91	2 28	28.90	2.40	29
30	29.93	2.09	29.92	2.22	29.91	2 35	29.90	2.48	30
31	30.92	2.16	30 91	2.30	30.90	2.43	30.89	2.57	31
32	31.92	2 23	31.91	2.37	31.90	2.51	31.89	2.65	32
33	32.92	2.30	32.91	2.45	32.90	2.59	32.89	2.73	33
34	33.92	2.37	33.91	2.52	33.90	2.67	33.88	2.82	34
35	34.91	2.44	34.90	2.59	34.89	2.75	34.88	2.90	35
36	35.91	2.51	35.90	2.67	35.89	2.82	35.88	2 98	36
37	36.91	2.58	36.90	2.74	36.89	2.90	36.87	3.06	37
38	37.91	2.65	37.90	2.82	37.88	2.98	37.87	3.15	38
39	38.90	2.72	38.89	2.89	38.88	3.06	38.87	3.23	39
40	39.90	2.79	39.89	2.96	39.88	3.14	39.86	3.31	40
41	40.90	2.86	40.89	3.04	40.87	3.22	40.86	3.40	41
42	41.90	2.93	41.88	3.11	41.87	3.30	41.86	3.48	42
43	42 90	6.00	42.88	3.19	42.87	3.37	42.85	3.56	43
44	43.89	3.07	43.88	3.26	43.86	3.45	43.85	3.64	44
45	44 89	3.14	44.88	3.34	44.86	3.53	44.85	3.73	45
46	45.89	3.21	45.87	3.41	45.86	3.61	45.84	3.81	46
47	46.89	3 28	46.87	3.48	46.86	3.69	46.84	3 89	47
48	47.88	3.35	47.87	3.56	47.85	3.77	47.84	3.97	48
49	48.88	3.42	48.87	3.63	48.85	3.84	48.83	4.06	49
50	49.88	3.49	49.86	3.71	49.85	3.92	49.83	4.14	50
Loa.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Loa.
	86 deg.	0 min.	85 deg.	45 min.	85 deg.	30 min.	85 deg.	15 min.	

Loa.	5 deg. 0 min.		5 deg. 15 min.		5 deg. 30 min.		5 deg. 45 min.		Loa.
	Lat	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	
1	1.00	0.09	1.00	0.09	1.00	0.10	1.00	0.10	1
2	1.99	0.17	1.99	0.18	1.99	0.19	1.99	0.20	2
3	2.99	0.26	2.99	0.27	2.99	0.29	2.98	0.30	3
4	3.98	0.35	3.98	0.37	3.98	0.38	3.98	0.40	4
5	4.98	0.44	4.98	0.46	4.98	0.48	4.97	0.50	5
6	5.98	0.52	5.97	0.55	5.97	0.58	5.97	0.60	6
7	6.97	0.61	6.97	0.64	6.97	0.67	6.96	0.70	7
8	7.97	0.70	7.97	0.73	7.96	0.77	7.96	0.80	8
9	8.97	0.78	8.96	0 82	8.96	0.86	8.95	0.90	9
10	9.96	0.87	9 96	0.92	9.95	0.96	9.95	1.00	10
11	10.96	0.96	10.95	1.01	10.95	1.05	10.94	1.10	11
12	11.95	1 05	11.95	1.10	11.94	1.15	11.94	1.20	12
13	12.95	1.13	12.95	1.19	12.94	1.25	12.93	1.30	13
14	13.95	1.22	13.94	1.28	13.94	1.34	13.93	1.40	14
15	14.94	1.31	14.94	1.37	14.93	1.44	14.92	1.50	15
16	15.91	1.39	15.93	1.46	15.93	1.54	15.92	1.60	16
17	16.94	1.48	16.93	1 56	16.92	1.63	16.91	1.70	17
18	17.93	1.57	17.92	1.65	17.92	1.73	17.91	1.80	18
19	18.93	1.66	18.92	1.74	18.91	1.82	18.90	3.90	19
20	19.92	1.71	19.92	1.83	19.91	1.92	19.90	2.00	20
21	20.92	1.83	20.91	1.92	20.90	2.01	20.89	2.10	21
22	21.92	1.92	21.91	2.01	21.90	2.11	21.89	2.20	22
23	22.91	2 00	22 90	2.10	22.89	2.20	22.88	2.30	23
24	23.91	2.09	23.90	2.20	23.89	2.30	23.88	2.40	24
25	24.90	2.18	24 90	2.29	24.89	2.40	24.87	2.50	25
26	25.90	2.27	25.89	2.38	25.88	2.49	25.87	2.60	26
27	26.90	2 35	26.89	2.47	36.88	2.59	26.86	2 71	27
28	27.89	2.44	27 88	2.56	27.87	2.68	27.86	2.81	28
29	28.89	2.53	28.88	2.65	28.87	2.78	28.85	2.91	29
30	29.89	2.61	29.87	2.75	29.86	2.88	29.85	3.01	30
31	30.88	2.70	30.87	2.84	30.86	2.97	30.84	3.11	31
32	31.88	2.79	31.87	2.93	31.85	3.07	31.84	3.21	32
33	32.87	2.88	32.86	3.02	32.85	3.16	32.83	3.31	33
34	33.87	2.96	33.86	3.11	33.84	3.26	33.83	3.41	34
35	34.87	3.05	34.85	3.20	34.84	3.35	34.82	3.51	35
36	35.86	3.14	35.85	3.29	35.83	3.45	35.82	3.61	36
37	36.86	3.22	36.84	3.39	36.83	3.55	36.81	3.71	37
38	37.86	3.31	37.84	3.48	37.83	3.64	37.81	3.81	38
39	38.85	3.40	38.84	3.57	38.82	3.74	38.80	3.91	39
40	39.85	3.49	39.83	3.66	39.82	3.83	39.80	4.01	40
41	40.84	3.57	40.83	3.75	40 81	3.93	40.79	4.11	41
42	41.84	3.66	41.82	3.84	41.81	4.03	41.79	4.21	42
43	42.84	3.75	42.82	3.93	42.80	4.12	42.78	4.31	43
44	43.83	3.84	43.82	4.03	43 80	4.22	43.78	4.41	44
45	44.83	3.92	44.81	4.12	44.79	4.31	44.77	4.51	45
46	45.82	4.01	45.81	4.21	45.79	4.41	45.77	4.61	46
47	46.82	4.10	46.80	4.30	46.78	4.51	46.76	4.71	47
48	47.82	4.18	47 80	4.39	47.78	4.60	47.76	4.81	48
49	48.81	4.27	48.79	4.48	48.77	4.70	48.75	4.91	49
50	49.81	4.36	49.79	4.58	49.77	4.79	49.75	5.01	50
Loa.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Loa.
	85 deg.	0 min.	84 deg.	45 min.	84 deg.	30 min.	84 deg.	15 min.	

Loa	6 deg. 0 min		6 deg 15 min.		6 deg 30 min		6 deg. 45 min.		Loa
	Lat.	Lon.	Lat	Lon.	Lat.	Lon.	Lat.	Lon.	
1	0.99	0.10	0.99	0.11	0.99	0.11	0.99	0.12	1
2	1.99	0.21	1.99	0.22	1.99	0.23	1.99	0.24	2
3	2.98	0.31	2.98	0.33	2.98	0.34	2.98	0.35	3
4	3.98	0.42	3.98	0.44	3.97	0.45	3.97	0.47	4
5	4.97	0 52	4.97	0.54	4.97	0.57	4.97	0.59	5
6	5.97	0.63	5.96	0.65	5.96	0.68	5.96	0.71	6
7	6.96	0.73	6.96	0 76	6.96	0.79	6.95	0.82	7
8	7.96	0.84	7.95	0.87	7.95	0.91	7 94	0.94	8
9	8.95	0 94	8.95	0 98	8.94	1·02	8.94	1.06	9
10	9.95	1.05	9.94	1 09	9.91	1.13	9 93	1.18	10
11	10.94	1.15	10.9	1 20	10.93	1.25	10.92	1 29	11
12	11.93	1.25	11.93	1.31	11.92	1.36	11.92	1.41	12
13	12.93	1.36	12.92	1.42	12.92	1.47	12.91	1.53	13
14	13.92	1.46	13.92	1.52	13.91	1.58	13.90	1.65	14
15	14.92	1.57	14 91	1.63	14.90	1.70	14.90	1.76	15
16	15.91	1.67	15.91	1.74	15.90	1.81	15.89	1.88	16
17	16.91	1.78	16.90	1 85	16.89	1.92	16.88	2.00	17
18	17.90	1.88	17.89	1.95	17.88	2.04	17.88	2.12	18
19	18.90	1.99	18 89	2.07	18.38	2.15	18 87	2.23	19
20	19.89	2 09	19.88	2.18	19 87	2.26	19.86	2.35	20
21	20.89	2.20	20.88	2.29	20.86	2.38	20.85	2.47	21
22	21.88	2.30	21.87	2.40	21.86	2.49	21.85	2.59	22
23	22.87	2.40	22.86	2.50	22.85	2.60	22.84	2 70	23
24	23.87	2.51	23.86	2.61	23.85	2.72	23.83	2.82	24
25	24.86	2.61	24.85	2.72	24.84	2.83	24.83	2.94	25
26	25.86	2.72	25.85	2.83	25 83	2 94	25.82	3.06	26
27	26.85	2.82	26.84	2.94	26.83	3 06	26.81	3.17	27
28	27.85	2.93	27.83	3.05	27.82	3 17	27.81	3 29	28
29	28.84	3.03	28.83	3.16	28.81	3.28	28.80	3.41	29
30	29.84	3 14	29.82	3.27	29.81	3.40	29.79	3.53	30
31	30.83	3.24	30.82	3.38	30 80	3 51	30.79	3.64	31
32	31.82	3.35	31.81	3 48	31.79	8.62	31.78	3.76	32
33	32.82	3.45	32.80	3.59	32.79	3 74	32.77	3.88	33
34	33.81	3.55	33.80	3.70	33.78	3.85	33.76	4.00	34
35	34.81	3.66	34.79	3.81	34.78	3.96	34.76	4.11	35
36	35.80	3.76	35.79	3.92	35.77	4.08	35.75	4.23	36
37	36.80	3.87	36.78	4.03	36.76	4.19	36.74	4.35	37
38	37.79	3.97	37.77	4.14	37.76	4.30	37.74	4.47	38
39	38.79	4.08	38.77	4.25	38.75	4.41	38.73	4 58	39
40	39.78	4.18	39.76	4.35	39 74	4.53	39.72	4.70	40
41	40.78	4.29	40.76	4.46	40.74	4.64	40.72	4.82	41
42	41.77	4.39	41.75	4.57	41.73	4.75	41.71	4.94	42
43	42.76	4.49	42.74	4.68	42.72	4.87	42.70	5.05	43
44	43.76	4.60	43.74	4.79	43.72	4.98	43.70	5.17	44
45	44.75	4.70	44.73	4.90	44.71	5.09	44.69	5.29	45
46	45.75	4.81	45.73	5.01	45.70	5.21	45.68	5.41	46
47	46.74	4.91	46.72	5.12	46.70	5 32	46.67	5.52	47
48	47.74	5.02	47.71	5 23	47.69	5.43	47.67	5.64	48
49	48.73	5.12	43.71	5.33	48.68	5.55	48.66	5.76	49
50	49.73	5 23	49.70	5.44	49.68	5.66	49.65	5.88	50
Loa.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Loa.
	84 deg.	0 min.	83 deg.	45 min.	83 deg.	30 min.	83 deg.	15 min.	

Loa.	7 deg. 0 min.		7 deg. 15 min.		7 deg. 30 min		7 deg. 45 min.		Loa.
	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	
1	0.99	0.12	0.99	0.13	0.99	0.13	0.99	0.13	1
2	1.99	0.24	1.98	0.25	1.98	0.26	1.98	0.27	2
3	2.98	0.37	2.98	0.38	2.97	0.39	2.97	0.40	3
4	3.97	0.49	3.97	0.50	3.97	0.52	3.96	0.54	4
5	4.96	0.61	4.96	0.63	4.96	0.65	4.95	0.67	5
6	5.96	0.73	5.95	0.76	5.95	0.78	5.95	0.81	6
7	6.95	0.85	6.94	0.88	6.94	0.91	6.94	0.94	7
8	7.94	0.98	7.94	1.01	7.93	1.04	7.93	1.08	8
9	8.93	1.10	8.93	1.14	8.92	1.17	8.92	1.21	9
10	9.93	1 22	9.92	1.26	9.91	1.31	0.91	1.35	10
11	10.92	1.34	10.91	1.39	10.91	1.44	10.90	1.48	11
12	11.91	1.46	11.90	1.51	11.90	1.57	11.89	1.62	12
13	12.90	1.58	12.90	1.64	12.89	1.70	12.88	1.75	13
14	13.90	1.71	13.89	1.77	13.88	1.83	13.87	1.89	14
15	14.89	1.83	14.88	1.89	14.87	1.96	14.86	2.02	15
16	15.88	1.95	15.87	2.02	15.86	2.09	15.85	2.16	16
17	16.87	2.07	16.86	2.15	16.85	2.22	16.84	2.29	17
18	17.87	2.19	17.86	2.27	17.85	2.35	17.84	2.43	18
19	18.86	2.32	18.85	2.40	18.84	2.48	18.83	2.56	19
20	19.85	3.44	19.84	2.52	19.83	2.61	19.82	2.70	20
21	20.84	2.56	20.83	2.65	20.82	2.74	20.81	2.83	21
22	21.84	2.68	21.82	2.78	21.81	2.87	21.80	2.97	22
23	22.83	2.80	22.82	2.90	22.80	3.00	22.79	3.10	23
24	23.82	2.92	23.81	3.03	23.79	3.13	23.78	3.24	24
25	24.81	3.05	24.80	3.16	24.79	3.26	24.77	3.37	25
26	25.81	3.17	25.79	3.28	25.78	3.39	25.76	3.51	26
27	26 80	3.29	26.78	3.41	26.77	3.52	26.75	3.64	27
28	27.79	3.41	27.78	3.53	27.76	3.65	27.74	3.78	28
29	28.78	3.53	28.77	3.66	28.75	3 79	28.74	3.91	29
30	29.78	3 66	29.76	3.79	29 74	3.92	29.73	4.05	30
31	30.77	3.78	30.75	3.91	30.73	4.05	30.72	4.18	31
32	31.76	3.90	31.74	4.04	31.73	4.18	31.71	4.32	32
33	32.75	4.02	32.74	4.16	32.72	4.31	32.70	4.45	33
34	33.75	4.14	33.73	4.29	33.71	4.44	33.69	4.58	34
35	34.74	4.29	34.72	4.42	34.70	4.57	34.68	4.72	35
36	35.73	4.39	35.71	4.54	35.69	4.70	35.67	4.85	36
37	36.72	4.51	36.70	4.67	36.68	4.83	36.66	4.99	37
38	37.72	4.63	37.70	4.80	37.67	4.96	37.65	5.12	38
39	38.71	4.75	38.69	4.92	38.67	5.09	38.64	5.26	39
40	39.70	4.87	39.68	5.05	39.66	5.22	39 63	5.39	40
41	40.69	5.00	40.67	5.17	40.65	5.35	40.63	5.53	41
42	41.69	5.12	41.66	5.30	41.64	5.48	41.62	5.66	42
43	42.68	5.24	42.66	5.43	42.63	5.61	42.61	5.80	43
44	43.67	5.36	43.65	5.55	43.62	5.74	43.60	5.93	44
45	44.66	5.48	44.64	5.68	44.61	5.87	44.59	6.07	45
46	45.66	5.61	45.63	5.81	45.61	6.00	45.58	6.20	46
47	46.65	5.73	46 62	5.93	46.60	6.13	46.57	6.34	47
48	47.64	5.85	47.62	6.06	47.59	6 27	47.56	6.47	48
49	48.64	5.97	48.61	6.18	48.58	6.40	48.55	6.61	49
50	49.63	6.09	49.60	6.31	49.57	6.53	49.54	6.74	50
Loa.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Loa.
	83 deg.	0 min.	82 deg.	45 min.	82 deg.	30 min.	82 deg.	15 min.	

Loa.	8 deg. 0 min.		8 deg. 15 min.		8 deg. 30 min.		8 deg. 45 min.		Loa.
	Lat	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	
1	0.99	0.14	0.99	0.14	0.99	0.15	0.99	0.15	1
2	1.98	0.28	1.98	0 29	1.98	0.30	1.98	0.30	2
3	2.97	0.42	2.97	0.43	2.97	0.44	2.97	0.46	3
4	3.96	0 56	3.96	0.57	3.96	0.59	3.95	0.61	4
5	4.95	0.70	4.95	0.72	4.95	0.74	4.94	0.76	5
6	5.94	0.84	5.94	0.86	5.93	0.89	5.93	0.91	6
7	6.93	0.97	6.93	1.00	6.92	1.03	6.92	1.06	7
8	7.92	1.11	7.92	1.15	7.91	1.18	7.91	1.22	8
9	8.91	1.25	8.91	1.29	8.90	1.33	8.90	1.37	9
10	9.90	1.39	9.90	1.43	9.89	1.48	9.88	1 52	10
11	10.89	1 53	10.89	1.58	10.88	1.63	10.87	1.67	11
12	11.88	1.67	11.88	1.72	11.87	1.77	11.86	1.83	12
13	12.87	1.81	12.87	1 87	12.86	1.92	12.85	1.98	13
14	13.86	1.95	13.86	2.01	13.85	2.07	13 84	2.13	14
15	14.85	2.09	14.84	2.15	14.84	2.22	14.83	2.28	15
16	15.84	2.23	15.83	2.30	15.82	2.36	15.81	2.43	16
17	16.83	2.37	16.82	2.44	16.81	2.51	16.80	2.59	17
18	17.82	2.51	17.81	2.58	17.80	2.66	17.79	2.74	18
19	18 82	2.64	18.80	2.73	18.79	2.81	18.78	2.89	19
20	19.81	2.78	19.79	2.87	19.78	2.96	19.77	3.04	20
21	20.80	2.92	20.78	3.01	20.77	3.10	20.76	3.19	21
22	21.79	3.06	21.77	3.16	21.76	3.25	21.74	3.35	22
23	22.78	3.20	22.76	3.30	22.75	3.40	22.73	3.50	23
24	23.77	3.34	23.75	3.44	23.74	3.55	23.72	3 65	24
25	24.76	3.48	24.74	3.59	24.73	3.70	24.71	3.80	25
26	25 75	3.62	25.73	3.73	25.71	3.84	25.70	3.96	26
27	26.74	3.76	26.72	3.87	26.70	3 99	26.69	4.11	27
28	27.73	3.90	27.71	4.02	27.69	4.14	27.67	4.26	28
29	28.72	4.04	28.70	4 16	28.68	4.29	28.66	4.41	29
30	29.71	4.18	29.69	4.30	29.67	4.43	29.65	4.56	30
31	30.70	4.31	30.68	4.45	30.66	4.58	30.64	4.72	31
32	31.69	4.45	31.67	4.59	31.65	4.73	31.63	4.87	32
33	32.68	4.59	32.66	4.74	32.64	4.88	32.62	5.02	33
34	33.67	4.73	33.65	4.88	33.63	5.03	33.60	5.17	34
35	34.66	4.87	34.64	5.02	34.62	5.17	34.59	5.32	35
36	35.65	5.01	35.63	5.17	35.60	5.32	35.58	5 48	36
37	36.64	5.15	36.62	5.31	36.59	5 47	36.57	5.63	37
38	37.63	5.29	37.61	5.45	37.58	5.62	37.56	5.78	38
39	38.62	5.43	38 60	5.60	38.57	5.76	38.55	5.93	39
40	39.61	5.57	39.59	5.74	39.56	5.91	39.53	6.08	40
41	40.60	5.71	40.58	5.88	40.55	6.06	40.52	6.24	41
42	41.59	5.85	41.57	6 03	41.54	6.21	41.51	6.39	42
43	42.58	5.98	42.56	6.17	42.53	6.36	42.50	6.54	43
44	43.57	6.12	43 54	6.31	43 52	6.50	43.49	6.69	44
45	44.56	6.26	44.53	6.46	44.51	6.65	44.48	6.85	45
46	45.55	6 40	45.52	6.60	45.49	6.80	45.46	7.00	46
47	46.54	6.54	46.51	6.74	46.48	6.95	46.45	7.15	47
48	47.53	6.68	47.50	6.89	47.47	7.09	47.44	7.30	48
49	48.52	6.82	48.49	7.03	48.46	7.24	48.43	7.45	49
50	49.51	6.96	49.48	7.17	49.45	7.39	49.42	7.61	50
Loa.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Loa.
	82 deg.	0 min.	81 deg.	45 min.	81 deg.	30 min.	81 deg.	15 min.	

Loa.	9 deg. 0 min.		9 deg. 15 min.		9 deg. 30 min.		9 deg. 45 min.		Loa.
	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	
1	0.99	0.16	0.99	0.16	0.99	0.17	0.99	0.17	1
2	1.98	0.31	1.97	0.32	1.97	0.33	1.97	0.34	2
3	2.96	0.47	2.96	0.48	2.96	0.50	2.96	0.51	3
4	3.95	0.63	3.95	0.64	3.95	0.66	3.94	0.68	4
5	4.94	0.78	4.94	0.80	4.93	0.83	4.93	0.85	5
6	5.93	0.94	5.92	0.96	5.92	0.99	5.91	1.02	6
7	6.91	1.10	6.91	1.13	6.90	1.16	6.90	1.19	7
8	7.90	1.25	7.90	1.29	7.89	1.32	7.88	1.35	8
9	8.89	1.41	8.88	1.45	8.88	1.49	8.87	1.52	9
10	9.88	1.56	9.87	1.61	9.86	1.65	9.86	1.69	10
11	10.86	1.72	10.86	1.77	10.85	1.82	10.84	1.86	11
12	11.85	1.88	11.84	1.93	11.84	1.98	11.83	2.03	12
13	12.84	2.03	12.83	2.09	12.82	2.15	12.81	2.20	13
14	13.83	2.19	13.82	2.25	13.81	2.31	13.80	2.37	14
15	14.82	2.35	14.81	2.41	14.79	2.48	14.78	2.54	15
16	15.80	2.50	15.79	2.57	15.78	2.64	15.77	2.71	16
17	16.79	2.66	16.78	2.73	16.77	2.81	16.75	2.88	17
18	17.78	2.82	17.77	2.89	17.75	2.97	17.74	3.05	18
19	18.77	2.97	18.75	3.05	18.74	3.14	18.73	3.22	19
20	19.75	3.13	19.74	3.21	19.73	3.30	19.71	3.39	20
21	20.74	3.29	20.73	3.38	20.71	3.47	20.70	3.56	21
22	21.73	3.44	21.71	3.54	21.70	3.63	21.68	3.73	22
23	22.72	3.60	22.70	3.70	22.68	3.80	22.67	3.90	23
24	23.70	3.75	23.69	3.86	23.67	3.96	23.65	4.06	24
25	24.69	3.91	24.68	4.02	24.66	4.13	24.64	4.23	25
26	25.68	4.07	25.66	4.18	25.64	4.29	25.62	4.40	26
27	26.67	4.22	26.65	4.34	26.63	4.46	26.61	4.57	27
28	27.66	4.38	27.64	4.50	27.62	4.62	27.60	4.74	28
29	28.64	4.54	28.62	4.66	28.60	4.79	28.58	4.91	29
30	29.63	4.69	29.61	4.82	29.59	4.95	29.57	5.08	30
31	30.62	4.85	30.60	4.98	30.58	5.12	30.55	5.25	31
32	31.61	5.01	31.58	5.14	31.56	5.28	31.54	5.42	32
33	32.59	5.16	32.57	5.30	32.55	5.45	32.52	5.59	33
34	33.58	5.32	33.56	5.47	33.53	5.61	33.51	5.76	34
35	34.57	5.48	34.55	5.63	34.52	5.78	34.49	5.93	35
36	35.56	5.63	35.53	5.79	35.51	5.94	35.48	6.10	36
37	36.54	5.79	36.52	5.95	36.49	6.11	36.47	6.27	37
38	37.53	5.94	37.51	6.11	37.48	6.27	37.45	6.44	38
39	38.52	6.10	38.49	6.27	38.47	6.44	38.44	6.60	39
40	39.51	6.26	39.48	6.43	39.45	6.60	39.42	6.77	40
41	40.50	6.41	40.47	6.59	40.44	6.77	40.41	6.94	41
42	41.48	6.57	41.45	6.75	41.42	6.93	41.39	7.11	42
43	42.47	6.73	42.44	6.91	42.41	7.10	42.38	7.28	43
44	43.46	6.88	43.43	7.07	43.40	7.26	43.36	7.45	44
45	44.45	7.04	44.42	7.23	44.38	7.43	44.35	7.62	45
46	45.43	7.20	45.40	7.39	45.37	7.59	45.34	7.79	46
47	46.42	7.35	46.39	7.55	46.36	7.76	46.32	7.96	47
48	47.41	7.51	47.38	7.72	47.34	7.92	47.31	8.13	48
49	48.40	7.67	48.36	7.88	48.33	8.09	48.29	8.30	49
50	49.38	7.82	49.35	8.04	49.31	8.25	49.28	8.47	50
Loa.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Loa.
	81 deg.	0 min.	80 deg.	45 min.	80 deg.	30 min.	80 deg.	15 min.	

Loa.	10 deg. 0 min.		10 deg. 15 min.		10 deg. 30 min.		10 deg. 45 min.		Loa.
	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	
1	0.98	0.17	0.98	0.18	0.98	0.18	0.98	0.19	1
2	1.97	0.35	1.97	0.36	1.97	0.36	1.96	0.37	2
3	2.95	0.52	2.95	0.53	2.95	0.55	2.95	0.56	3
4	3.94	0.69	3.94	0.71	3.93	0.73	3.93	0.75	4
5	4.92	0.87	4.92	0.89	4.92	0.91	4.91	0.93	5
6	5.91	1.04	5.90	1.07	5.90	1.09	5.89	1.12	6
7	6.89	1.22	6.89	1.25	6.88	1.28	6.88	1.31	7
8	7.88	1.39	7.87	1.42	7.87	1.46	7.86	1.49	8
9	8.86	1.56	8.86	1.60	8.85	1.64	8.84	1.68	9
10	9.85	1.74	9.84	1.78	9.83	1.82	9.82	1.87	10
11	10.83	1.91	10.82	1.96	10.82	2.00	10.81	2.05	11
12	11.82	2.08	11.81	2.14	11.80	2.19	11.79	2.24	12
13	12.80	2.26	12.79	2.31	12.78	2.37	12.77	2.42	13
14	13.79	2.43	13.78	2.49	13.77	2.55	13.75	2.61	14
15	14.77	2.60	14.76	2.67	14.75	2.73	14.74	2.80	15
16	15.76	2.78	15.74	2.85	15.73	2.92	15.72	2.98	16
17	16.74	2.95	16.73	3.03	16.72	3.10	16.70	3.17	17
18	17.73	3.13	17.71	3.20	17.70	3.28	17.68	3.36	18
19	18.71	3.30	18.70	3.38	18.68	3.46	18.67	3.54	19
20	19.70	3.47	19.68	3.56	19.67	3.64	19.65	3.73	20
21	20.68	3.65	20.66	3.74	20.65	3.83	20.63	3.92	21
22	21.67	3.82	21.65	3.91	21.63	4.01	21.61	4.10	22
23	22.65	3.99	22.63	4.09	22.61	4.19	22.60	4.29	23
24	23.64	4.17	23.62	4.27	23.60	4.37	23.58	4.48	24
25	24.62	4.34	24.60	4.45	24.58	4.56	24.56	4.66	25
26	25.61	4.51	25.59	4.63	25.56	4.74	25.54	4.85	26
27	26.59	4.69	26.57	4.80	26.55	4.92	26.53	5.04	27
28	27.57	4.86	27.55	4.98	27.53	5.10	27.51	5.22	28
29	28.56	5.04	28.54	5.16	28.51	5.29	28.49	5.41	29
30	29.54	5.21	29.52	5.34	29.50	5.47	29.47	5.60	30
31	30.53	5.38	30.51	5.52	30.48	5.65	30.46	5.78	31
32	31.51	5.56	31.49	5.69	31.46	5.83	31.44	5.97	32
33	32.50	5.73	32.47	5.87	32.45	6.01	32.42	6.16	33
34	33.48	5.90	33.46	6.05	33.43	6.20	33.40	6.34	34
35	34.47	6.08	34.44	6.23	34.41	6.38	34.39	6.53	35
36	35.45	6.25	35.43	6.41	35.40	6.56	35.37	6.71	36
37	36.44	6.43	36.41	6.58	36.38	6.74	36.35	6.90	37
38	37.42	6.60	37.39	6.76	37.36	6.93	37.33	7.09	38
39	38.41	6.77	38.38	6.94	38.35	7.11	38.32	7.27	39
40	39.39	6.95	39.36	7.12	39.33	7.29	39.30	7.46	40
41	40.38	7.12	40.35	7.30	40.31	7.47	40.28	7.65	41
42	41.36	7.29	41.33	7.47	41.30	7.65	41.26	7.83	42
43	42.35	7.47	42.31	7.65	42.28	7.84	42.25	8.02	43
44	43.33	7.64	43.30	7.83	43.26	8.02	43.23	8.21	44
45	44.32	7.81	44.28	8.01	44.25	8.20	44.21	8.39	45
46	45.30	7.99	45.27	8.19	45.23	8.38	45.19	8.58	46
47	46.29	8.16	46.25	8.36	46.21	8.57	46.18	8.77	47
48	47.27	8.34	47.23	8.54	47.20	8.75	47.16	8.95	48
49	48.26	8.51	48.22	8.72	48.18	8.93	48.14	9.14	49
50	49.24	8.68	49.20	8.90	49.16	9.11	49.12	9.33	50
Loa.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Loa.
	80 deg. 0 min.		79 deg. 45 min.		79 deg. 30 min.		79 deg. 15 min.		

Loa.	11 deg. 0 min.		11 deg. 15 min.		11 deg. 30 min		11 deg. 45 min.		Loa.
	Lat.	Lon.	Lat	Lon.	Lat.	Lon.	Lat.	Lon.	
1	0.19	0.19	0.98	0.20	0.98	0.20	0.98	0.20	1
2	1.96	0.38	1.96	0.39	1.96	0.40	1.96	0.41	2
3	2.94	0.57	2.94	0.59	2.94	0.60	2.94	0.61	3
4	3 93	0.76	3.92	0.78	3.92	0.80	3.92	0.81	4
5	4.91	0.95	4.90	0.98	4.90	1.00	4.90	1.02	5
6	5.89	1.14	5.88	1.17	5.88	1.20	5.87	1.22	6
7	6.87	1.34	6.87	1.37	6.86	1.40	6.85	1.43	7
8	7.85	1.53	7.85	1.56	7.84	1.60	7.83	1.63	8
9	8.83	1.72	8.83	1.76	8.82	1.79	8.81	1.83	9
10	9.82	1.91	9.81	1.95	9.80	1.99	9.79	2.04	10
11	10 80	2.10	10.79	2.15	10.78	2.19	10.77	2.24	11
12	11.78	2.29	11.77	2.34	11.76	2.39	11.75	2.44	12
13	12.76	2.48	12.75	2.54	12.74	2.59	12.73	2.65	13
14	13.74	2.67	13.73	2.73	13.72	2.79	13.71	2.85	14
15	14.72	2.86	14.71	2.93	14.70	2.99	14.69	3.05	15
16	15.71	3.05	15.69	3.12	15.68	3.19	15.66	3.26	16
17	16.69	3.24	16.67	3.32	16.66	3.39	16.64	3.46	17
18	17.67	3.43	17.65	3.51	17.64	3.59	17.62	3.67	18
19	18.65	3.63	18.64	3.71	18.62	3.79	18.60	3.87	19
20	19.63	3.82	19.62	3.90	19.60	3.99	19.58	4.07	20
21	20.61	4.01	20.60	4.10	20.58	4.19	20.56	4.28	21
22	21.60	4.20	21.58	4.29	21.56	4.39	21.54	4.48	22
23	22.58	4.39	22.56	4.49	22.54	4.59	22.52	4.68	23
24	23.56	4.58	23.54	4.68	23.52	4.78	23.50	4.89	24
25	24.54	4.77	24.52	4.88	24 50	4.98	24.48	5.09	25
26	25.52	4 96	25.50	5.07	25.48	5 18	25.46	5.29	26
27	26.50	5.15	26.48	5.27	26.46	5.38	26.43	5.50	27
28	27.49	5.34	27.46	5.46	27.44	5.58	27.41	5 70	28
29	28.47	5.53	28.44	5.66	28.42	5.78	28.39	5 91	29
30	29.45	5.72	29.42	5.85	29.40	5.98	29.37	6.11	30
31	30.43	5.92	30.40	6.05	30.38	6.18	30.35	6.31	31
32	31.41	6.11	31.39	6.24	31.36	6.38	31.33	6.52	32
33	32.39	6.30	32.37	6.44	32.34	6.58	32 31	6.72	33
34	33.38	6.49	33.35	6.63	33.32	6.78	33.29	6.92	34
35	34.36	6.68	34.33	6.83	34 30	6.98	34.27	7.13	35
36	35. 34	6.87	35.31	7.02	35.28	7 18	35.25	7.33	36
37	36 32	7.06	36.29	7.22	36.26	7.38	36.22	7.53	37
38	37.30	7.25	37.27	7.41	37.24	7.58	37.20	7.74	38
39	38.28	7.44	38.25	7.61	38.22	7.78	38.18	7.94	39
40	39.27	7 63	39.23	7.80	39.20	7.97	39.16	8 15	40
41	40.25	7.82	40.21	8.00	40.18	8 17	40.14	8.35	41
42	41.23	8.01	41.19	8.19	41.16	8.37	41.12	8.55	42
43	42.21	8.20	42.17	8.39	42.14	8.57	42.10	8 76	43
44	43.19	8.40	43.15	8.58	43.12	8.77	43.08	8.96	44
45	44.17	8 59	44.14	8.78	14.10	8.97	44.06	9 16	45
46	45.16	8.78	45.12	8 97	45.08	9.17	45 04	9.37	46
47	46.14	8.97	46.10	9.17	46.06	9.37	46 02	9 57	47
48	47.12	9.16	47.08	9.36	47 04	9.57	46.99	9.77	48
49	48 10	9.35	48.06	9.56	48 02	9.77	47.97	9 98	49
50	49.08	9.54	49.04	9.75	49.00	9 97	48.95	10.18	50
Loa.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Loa.
	79 deg.	0 min.	78 deg.	45 min.	78 deg.	30 min.	78 deg.	15 min.	

Lea.	12 deg. 0 min.		12 deg. 15 min.		12 deg. 30 min.		12 deg. 45 min.		Lea.
	Lat	Lon.	Lat.	Lon	Lat.	Lon.	Lat.	Lon.	
1	0.98	0.21	0.98	0.21	0.98	0.22	0.98	0.22	1
2	1.96	0.42	1.95	0.42	1.95	0.43	1.95	0.44	2
3	2.93	0.62	2.93	0 64	2.93	0.65	2.93	0.66	3
4	3.91	0.83	3.91	0.85	3.91	0.87	3.90	0.88	4
5	4.89	1.04	4.89	1.06	4.88	1.03	4.88	1.10	5
6	5.87	1.25	5.86	1.27	5.86	1.30	5.85	1.32	6
7	6.85	1.46	6.84	1.49	6.83	1.52	6.83	1.54	7
8	7.83	1.66	7.82	1.70	7.81	1.73	7.80	1.77	8
9	8.80	1.87	8.80	1.91	8.79	1.95	8.78	1.99	9
10	9.78	2.03	9.77	2.12	9.76	2.16	9 75	2.21	10
11	10.76	2.29	10.75	2 33	10.74	2.38	10.73	2.43	11
12	11.74	2.49	11.73	2.55	11.72	2.60	11.70	2.65	12
13	12.72	2.70	12.70	2.76	12.69	2.81	12.68	2 87	13
14	13.69	2.91	13.68	2.97	13.67	3.03	13.65	3.09	14
15	14.67	3.12	14.66	3.18	14 64	3.25	14.63	3.31	15
16	15.65	3.33	15.64	3 39	15.62	3.46	15.61	3.53	16
17	16.63	3.53	16.61	3.61	16.60	3.68	16.58	3.75	17
18	17.61	3.74	17.59	3.82	17.57	3.90	17 56	3.97	18
19	18.58	3.95	18.57	4 03	18.55	4.11	18 53	4.19	19
20	19.56	4.16	19.54	4.24	19.53	4.33	19 51	4 41	20
21	20.54	4.37	20.52	4.45	20 50	4.55	20.48	4 63	21
22	21.52	4.57	21.50	4.67	21.48	4.76	21 46	4.86	22
23	22.50	4.78	22 48	4.88	22 45	4.98	22.43	5.08	23
24	23.48	4.99	23.45	5.09	23.43	5.19	23.41	5.30	24
25	24 45	5 20	24.43	5.30	24.41	5 41	24.38	5.52	25
26	25.43	5 41	25 41	5 52	25.38	5.63	25.36	5 74	26
27	26.41	5.61	26.39	5.73	26 36	5 84	26.33	5 96	27
28	27.39	5.82	27.36	5.94	27.34	6.06	27.31	6.18	28
29	28 37	6.03	28.34	6.15	28.31	6.28	28.28	6.40	29
30	29.34	6.24	29.32	6 37	29. 9	6.49	29 26	6.62	30
31	30.32	6.45	30.29	6.58	30.27	6.71	30.24	6.84	31
32	31.30	6.65	31.27	6.79	31.24	6.93	31.21	7.06	32
33	32.28	6.86	32.25	7.00	32.22	7.14	32.19	7.28	33
34	33.26	7.07	33.23	7.21	33.19	7.36	33.16	7.50	34
35	34.24	7.28	34.20	7.43	34.17	7.58	34.14	7.72	35
36	35.21	7.48	35.18	7.64	35.15	7 79	35.11	7 9	36
37	36.19	7 69	36.16	7.85	36.12	8.01	36.09	8.17	37
38	37.17	7.90	37.13	8.06	37 10	8.22	37 07	8.39	38
39	38.15	8.11	38.11	8.28	38.08	8.44	38 04	8 61	39
40	39 13	8 32	39.09	8 49	39 05	8 66	39.01	8.83	40
41	40.10	8.52	40.07	8.70	40.03	8.87	39.99	9 05	41
42	41.08	8.73	41.04	8 91	41.00	9.09	40 96	9.27	42
43	42.06	8.94	42.02	9 12	41.98	9.31	41.94	9.49	43
44	43.04	9.15	43.00	9.34	42.96	9.52	42.92	9 71	44
45	44 02	9 36	43.98	9.55	43 93	9.74	43.89	9.93	45
46	44.99	9.56	44.95	9.76	44 91	9.96	44.87	10.15	46
47	45.97	9.77	45 93	9.97	45.89	10.17	45.84	10.37	47
48	46.95	9 98	46.91	10.18	46.86	10.39	46.82	10.59	48
49	47.93	10.19	47.88	10.40	47 84	10.61	47.79	10.81	49
50	48 91	10.40	48.86	10.61	48.82	10.82	48.77	11.04	50
Loa.	Lon.	Lat.	Lon.	at	Lon.	Lat.	Lon.	Lat.	Loa.
	78 deg.	0 min.	77 deg.	45 min.	77 deg.	30 min.	77 deg.	15 min.	

Loa.	13 deg. 0 min.		13 deg. 15 min.		13 deg. 30 min.		13 deg. 45 min.		Loa.
	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	
1	0.97	0.23	0.97	0.23	0.97	0.23	0.97	0.24	1
2	1.95	0.45	1.95	0.46	1.94	0.47	1.94	0.48	2
3	2.92	0.67	2.92	0.69	2.92	0.70	2.91	0.71	3
4	3.90	0.90	3.89	0.92	3.89	0.93	3.89	0.95	4
5	4.87	1.12	4.87	1.15	4.86	1.17	4.86	1.19	5
6	5.85	1.35	5.84	1.38	5.83	1.40	5.83	1.43	6
7	6.82	1.57	6.81	1.60	6.81	1.63	6.80	1.66	7
8	7.80	1.80	7.79	1.83	7.78	1.87	7.77	1.90	8
9	8.77	2.02	8.76	2.06	8.75	2.10	8.74	2.14	9
10	9.74	2.25	9.73	2.29	9.72	2.33	9.71	2.38	10
11	10.72	2.47	10.71	2.52	10.70	2.57	10.68	2.61	11
12	11.69	2.70	11.68	2.75	11.67	2.80	11.66	2.85	12
13	12.67	2.92	12.65	2.98	12.64	3.03	12.63	3.09	13
14	13.64	3.15	13.63	3.21	13.61	3.27	13.60	3.33	14
15	14.62	3.37	14.60	3.44	14.59	3.50	14.57	3.57	15
16	15.59	3.60	15.57	3.67	15.56	3.74	15.54	3.80	16
17	16.56	3.82	16.55	3.90	16.53	3.97	16.51	4.04	17
18	17.54	4.05	17.52	4.13	17.50	4.20	17.48	4.28	18
19	18.51	4.27	18.49	4.35	18.48	4.44	18.46	4.52	19
20	19.49	4.50	19.47	4.58	19.45	4.67	19.43	4.75	20
21	20.46	4.72	20.44	4.81	20.42	4.90	20.40	4.99	21
22	21.44	4.95	21.41	5.04	21.39	5.14	21.37	5.23	22
23	22.41	5.17	22.39	5.27	22.36	5.37	22.34	5.47	23
24	23.38	5.40	23.36	5.50	23.34	5.60	23.31	5.70	24
25	24.36	5.62	24.33	5.73	24.31	5.84	24.28	5.94	25
26	25.33	5.85	25.31	5.96	25.28	6.07	25.25	6.18	26
27	26.31	6.07	26.28	6.19	26.25	6.30	26.23	6.42	27
28	27.28	6.30	27.25	6.42	27.23	6.54	27.20	6.66	28
29	28.26	6.52	28.23	6.65	28.20	6.77	28.17	6.89	29
30	29.23	6.75	29.20	6.88	29.17	7.00	29.14	7.13	30
31	30.21	6.97	30.17	7.11	30.14	7.24	30.11	7.37	31
32	31.18	7.20	31.15	7.33	31.12	7.47	31.08	7.61	32
33	32.15	7.42	32.12	7.56	32.09	7.70	32.05	7.84	33
34	33.13	7.65	33.09	7.79	33.06	7.94	33.03	8.08	34
35	34.10	7.87	34.07	8.02	34.03	8.17	34.00	8.32	35
36	35.08	8.10	35.04	8.25	35.01	8.40	34.97	8.56	36
37	36.05	8.32	36.02	8.48	35.98	8.64	35.94	8.79	37
38	37.03	8.55	36.99	8.71	36.95	8.87	36.91	9.03	38
39	38.00	8.77	37.96	8.94	37.92	9.10	37.88	9.27	39
40	38.97	9.00	38.94	9.17	38.89	9.34	38.85	9.51	40
41	39.95	9.22	39.91	9.40	39.87	9.57	39.82	9.75	41
42	40.92	9.45	40.88	9.63	40.84	9.80	40.80	9.98	42
43	41.90	9.67	41.86	9.86	41.81	10.04	41.77	10.22	43
44	42.87	9.90	42.83	10.08	42.78	10.27	42.74	10.46	44
45	43.85	10.12	43.80	10.31	43.76	10.51	43.71	10.70	45
46	44.82	10.35	44.78	10.54	44.73	10.74	44.68	10.93	46
47	45.80	10.57	45.75	10.77	45.70	10.97	45.65	11.17	47
48	46.77	10.80	46.72	11.00	46.67	11.21	46.62	11.41	48
49	47.74	11.02	47.70	11.23	47 65	11.44	47.60	11.65	49
50	48.72	11.25	48.67	11.46	48.62	11.67	48.57	11.88	50
Loa.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Loa.
	77 deg. 0 min.		76 deg. 45 min.		76 deg. 30 min.		76 deg. 15 min.		

Loa.	14 deg. 0 min.		14 deg. 15 min.		14 deg. 30 min.		14 deg. 45 min.		Loa.
	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	
1	0.97	0.24	0.97	0.25	0.97	0.25	0.97	0.25	1
2	1.94	0.48	1.94	0.49	1.94	0.50	1.93	0.51	2
3	2.91	0.73	2.91	0.74	2.90	0.75	2.90	0.76	3
4	3.88	0.97	3.88	0.98	3.87	1.00	3.87	1.02	4
5	4.85	1.21	4.85	1.23	4.84	1.25	4.84	1.27	5
6	5.82	1.45	5.82	1.48	5.81	1.50	5.80	1.53	6
7	6.79	1.69	6.78	1.72	6.78	1.75	6.77	1.78	7
8	7.76	1.94	7.75	1.97	7.75	2.00	7.74	2.04	8
9	8.73	2.18	8.72	2.22	8.71	2.25	8.70	2.29	9
10	9.70	2.42	9.69	2.46	9.68	2.50	9.67	2.55	10
11	10.67	2.66	10.66	2.71	10.65	2.75	10.64	2.80	11
12	11.64	2.90	11.63	2.95	11.62	3.00	11.60	3.06	12
13	12.61	3.14	12.60	3.20	12.59	3.25	12.57	3.31	13
14	13.58	3.39	13.57	3.45	13.55	3.51	13.54	3.56	14
15	14.55	3.63	14.54	3.69	14.52	3.76	14.51	3.82	15
16	15.52	3.87	15.51	3.94	15.49	4.01	15.47	4.07	16
17	16.50	4.11	16.48	4.18	16.46	4.26	16.44	4.33	17
18	17.47	4.35	17.45	4.43	17.43	4.51	17.41	4.58	18
19	18.44	4.60	18.42	4.68	18.39	4.76	18.37	4.84	19
20	19.41	4.84	19.38	4.92	19.36	5.01	19.34	5.09	20
21	20.38	5.08	20.35	5.17	20.33	5.26	20 31	5.35	21
22	21.35	5.32	21.32	5.42	21.30	5.51	21.28	5.60	22
23	22.32	5.56	22.29	5.66	22.27	5.76	22.24	5.86	23
24	23.29	5.81	23.26	5.91	23.24	6.01	23.21	6.11	24
25	24.26	6.05	24.23	6.15	24.20	6.26	24.18	6.36	25
26	25.23	6.29	25.20	6.40	25.17	6.51	25.14	6.62	26
27	26.20	6.53	26.17	6.65	26.14	6.76	26.11	6.87	27
28	27.17	6.77	27.14	6.89	27.11	7.01	27.08	7.13	28
29	28.14	7.02	28.11	7.14	28.08	7.26	28.04	7.38	29
30	29.11	7.26	29.08	7.38	29.04	7.51	29.01	7.64	30
31	30.08	7.50	30.05	7.63	30.01	7.76	29.98	7.89	31
32	31.05	7.74	31.02	7.88	30.98	8.01	30.95	8.15	32
33	32.02	7.98	31.98	8.12	31.95	8.26	31.91	8.40	33
34	32.99	8.23	32.95	8.37	32.92	8.51	32.88	8.66	34
35	33.96	8.47	33.92	8.62	33.89	8.76	33.85	8.91	35
36	34.93	8.71	34.89	8.86	34.85	9.01	34.81	9.17	36
37	35.90	8.95	35.86	9.11	35.82	9.26	35.78	9.42	37
38	36.87	9.19	36.83	9.35	36.79	9.51	36.75	9.67	38
39	37.84	9.43	37.80	9.60	37.76	9.76	37.71	9.93	39
40	38.81	9.68	38.77	9.85	38.73	10.02	38.68	10.18	40
41	39.78	9.92	39.74	10.09	39.69	10.27	39.65	10.44	41
42	40.75	10.16	40.71	10.34	40.66	10.52	40.62	10.69	42
43	41.72	10.40	41.68	10.58	41.63	10.77	41.58	10.95	43
44	42.69	10.64	42.65	10.83	42.60	11.02	42.55	11.20	44
45	43.66	10.89	43.62	11.08	43.57	11.27	43.52	11.46	45
46	44.63	11.13	44.58	11.32	44.53	11.52	44.48	11.71	46
47	45.60	11.37	45.55	11.57	45.50	11.77	45.45	11.97	47
48	46.57	11.61	46.52	11.82	46.47	12.02	46.42	12.22	48
49	47.54	11.85	47.49	12.06	47.44	12.27	47.39	12.48	49
50	48.51	12.10	48.46	12.31	48.41	12.52	48.35	12.73	50
Loa.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Loa.
	76 deg. 0 min.		75 deg. 45 min.		75 deg. 30 min.		75 deg. 15 min.		

Loa.	15 deg. 0 min.		15 deg. 15 min.		15 deg. 30 min.		15 deg. 45 min.		Loa.
	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	
1	0.97	0.26	0.96	0.26	0.96	0.27	0.96	0.27	1
2	1.93	0.52	1.93	0.53	1.93	0.53	1.92	0.54	2
3	2.90	0.78	2.89	0.79	2.89	0.80	2.89	0.81	3
4	3.86	1.04	3.86	1.05	3.85	1.07	3.85	1.09	4
5	4.83	1.29	4.82	1.32	4.82	1.34	4.81	1.36	5
6	5.80	1.55	5.79	1.58	5.78	1.60	5.77	1.63	6
7	6.76	1.81	6.75	1.84	6.75	1.87	6.74	1.90	7
8	7.73	2.07	7.72	2.10	7.71	2.14	7.70	2.17	8
9	8.69	2.33	8.68	2.37	8.67	2.41	8.66	2.44	9
10	9.66	2.59	9.65	2.63	9.64	2.67	9.62	2.71	10
11	10.63	2.85	10.61	2.89	10.60	2.94	10.59	2.99	11
12	11.59	3.11	11.58	3.16	11.56	3.21	11.55	3.26	12
13	12.56	3.36	12.54	3.42	12.53	3.47	12.51	3.53	13
14	13.52	3.62	13.51	3.68	13.49	3.74	13.47	3.80	14
15	14.49	3.88	14.47	3.95	14.45	4.01	14.44	4.07	15
16	15.45	4.14	15.44	4.21	15.42	4.28	15.40	4.34	16
17	16.42	4.40	16.40	4.47	16.38	4.54	16.36	4.61	17
18	17.39	4.66	17.37	4.73	17.35	4.81	17.32	4.89	18
19	18.35	4.92	18.33	5.00	18.31	5.08	18.29	5.16	19
20	19.32	5.18	19.30	5.26	19.27	5.34	19.25	5.43	20
21	20.28	5.44	20.26	5.52	20.24	5.61	20.21	5.70	21
22	21.25	5.69	21.23	5.79	21.20	5.88	21.17	5.97	22
23	22.22	5.95	22.19	6.05	22.16	6.15	22.14	6.24	23
24	23.18	6.21	23.15	6.31	23.13	6.41	23.10	6.51	24
25	24.15	6.47	24.12	6.58	24.09	6.68	24.06	6.79	25
26	25.11	6.73	25.08	6.84	25.05	6.95	25.02	7.06	26
27	26.08	6.99	26.05	7.10	26.02	7.22	25.99	7.33	27
28	27.05	7.25	27.01	7.36	26.98	7.48	26.95	7.60	28
29	28.01	7.51	27.98	7.63	27.95	7.75	27.91	7.87	29
30	28.98	7.76	28.94	7.89	28.91	8.02	28.87	8.14	30
31	29.94	8.02	29.91	8.15	29.87	8.28	29.84	8.41	31
32	30.91	8.28	30.87	8.42	30.84	8.55	30.80	8.69	32
33	31.88	8.54	31.84	8.68	31.80	8.82	31.76	8.96	33
34	32.84	8.80	32.80	8.94	32.76	9.09	32.72	9.23	34
35	33.81	9.06	33.77	9.21	33.73	9.35	33.69	9.50	35
36	34.77	9.32	34.73	9.47	34.69	9.62	34.65	9.77	36
37	35.74	9.58	35.70	9.73	35.65	9.89	35.61	10.04	37
38	36.71	9.84	36.66	10.00	36.62	10.16	36.57	10.31	38
39	37.67	10.09	37.63	10.26	37.58	10.42	37.54	10.59	39
40	38.64	10.35	38.59	10.52	38.55	10.69	38.50	10.86	40
41	39.60	10.61	39.56	10.78	39.51	10.96	39.46	11.13	41
42	40.57	10.87	40.52	11.05	40.47	11.22	40.42	11.40	42
43	41.53	11.13	41.49	11.31	41.44	11.49	41.39	11.67	43
44	42.50	11.39	42.45	11.57	42.40	11.76	42.35	11.94	44
45	43.47	11.65	43.42	11.84	43.36	12.03	43.31	12.21	45
46	44.43	11.91	44.38	12.10	44.33	12.29	44.27	12.49	46
47	45.40	12.16	45.35	12.36	45.29	12.56	45.24	12.76	47
48	46.36	12.42	46.31	12.63	46.25	12.83	46.20	13.03	48
49	47.33	12.68	47.27	12.89	47.22	13.09	47.16	13.30	49
50	48.30	12.94	48.24	13.15	48.18	13.26	48.12	13.57	50
Loa.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Loa.
	75 deg. 0 min.		74 deg. 45 min.		74 deg. 30 min.		74 deg. 15 min.		

Loa.	16 deg. 0 min.		16 deg. 15 min.		16 deg. 30 min.		16 deg. 45 min.		Loa.
	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	
1	0.96	0.28	0.96	0.23	0.96	0.28	0.96	0.29	1
2	1.92	0.55	1.92	0.56	1.92	0.57	1.92	0.58	2
3	2.88	0.83	2.88	0.84	2.88	0.85	2.87	0.86	3
4	3.85	1.10	3.84	1.12	3.84	1.14	3.83	1.15	4
5	4.81	1.38	4.80	1.40	4.79	1.42	4.79	1.44	5
6	5.77	1.65	5.76	1.68	5.75	1.70	5.75	1.73	6
7	6.73	1.93	6.72	1.96	6.71	1.99	6.70	2.02	7
8	7.69	2.21	7.68	2.24	7.67	2.27	7.66	2.31	8
9	8.65	2.48	8.64	2.52	8.63	2.56	8.62	2.59	9
10	9.61	2.76	9.60	2.80	9.59	2.84	9.58	2.88	10
11	10.57	3.03	10.56	3.08	10.55	3.12	10.53	3.17	11
12	11.54	3.31	11.52	3.36	11.51	3.41	11.49	3.46	12
13	12.50	3.58	12.48	3.64	12.46	3.69	12.45	3.75	13
14	13.46	3.86	13.44	3.92	13.42	3 98	13.41	4.03	14
15	14.42	4.13	14.40	4.20	14.38	4.26	14.36	4.32	15
16	15.38	4.41	15.36	4.48	15.34	4.54	15.32	4.61	16
17	16.34	4.69	16.32	4.76	16.30	4.83	16.28	4.90	17
18	17.30	4 96	17.28	5.04	17.26	5.11	17.24	5.19	18
19	18.26	5.24	18.24	5.32	18.22	5.40	18.19	5.48	19
20	19.23	5.51	19.20	5.60	19.18	5.68	19.15	5.76	20
21	20.19	5.79	20.16	5.88	20.14	5.96	20.11	6.05	21
22	21.15	6.06	21.12	6.16	21 09	6.25	21.07	6.34	22
23	22.11	6.34	22.08	6.44	22.05	6.53	22.02	6.63	23
24	23.07	6.62	23.04	6.72	23.01	6.82	22.98	6.92	24
25	24.03	6.89	24.00	7.00	23.97	7.10	23.94	7.21	25
26	24.99	7.17	24.96	7.28	24.93	7.38	24.90	7.49	26
27	25.95	7.44	25.92	7.56	25.89	7.67	25.85	7.78	27
28	26.92	7.72	26.88	7.84	26.85	7.95	26.81	8.07	28
29	27·88	7.99	27.84	8.12	27.81	8.24	27.77	8.36	29
30	28.84	8.27	28.80	8.39	28.76	8.52	28.73	8.65	30
31	29.80	8.54	29.76	8.67	29.72	8.80	29.68	8.93	31
32	30.76	8.82	30.72	8.95	30.68	9.09	30.64	9.22	32
33	31.72	9.10	31.68	9.23	31.64	9.37	31.60	9.51	33
34	32.68	9.37	32.64	9.51	32.60	9.66	32.56	9.80	34
35	33.64	9.65	33.60	9.79	33.56	9.94	33.51	10.09	35
36	34.61	9.92	34.56	10.07	34.52	10.22	34.47	10.38	36
37	35.57	10.20	35.52	10.35	35.48	10.51	35.43	10.66	37
38	36.53	10.47	36.48	10.63	36.44	10.79	36.39	10.95	38
39	37.49	10.75	37.44	10.91	37.99	11.08	37.35	11.24	39
40	38.45	11.03	38.40	11.19	38.35	11.36	38.30	11.53	40
41	39.41	11.30	39.36	11.47	39.31	11.64	39.26	11.82	41
42	40.37	11.58	40.32	11.75	40.27	11.93	40.22	12.10	42
43	41.33	11.85	41.28	12.03	41.23	12.21	41.18	12.39	43
44	42.30	12.13	42.24	12.31	42.19	12.50	42.13	12.68	44
45	43.26	12.40	43.20	12.59	43.15	12.78	43.09	12.97	45
46	44.22	12.68	44.16	12.87	44.11	13.06	44.05	13.26	46
47	45.18	12.96	45.12	13.15	45.06	13.35	45.01	13.55	47
48	46.14	13·23	46.08	13.43	46.02	13.63	45.96	13.83	48
49	47.10	13.51	47.04	13.71	46.98	13.92	46.92	14.12	49
50	48.06	13.78	48.00	13.99	47·94	14.20	47.88	14.41	50
Loa.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Loa.
	74 deg.	0 min.	73 deg.	45 min.	73 deg.	30 min.	73 deg.	15 min.	

Loa.	17 deg. 0 min.		17 deg. 15 min.		17 deg. 30 min.		17 deg. 45 min.		Loa.
	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	
1	0.96	0.29	0.96	0.30	0.95	0 30	0.95	0.30	1
2	1.91	0.58	1.91	0.59	1.91	0.60	1.90	0.61	2
3	2.87	0.88	2.87	0.89	2.86	0.90	2.86	0.91	3
4	3.83	1.17	3.82	1.19	3.81	1.20	3.81	1.22	4
5	4.78	1.46	4.78	1.48	4.77	1.50	4.76	1.52	5
6	5.74	1.75	5.73	1.78	5.72	1.80	5.71	1.83	6
7	6.69	2.05	6.69	2.08	6.68	2.10	6.67	2.13	7
8	7.65	2.34	7.64	2.37	7.63	2.41	7.62	2.44	8
9	8.61	2.63	8.60	2.67	8.58	2.71	8.57	2.74	9
10	9.56	2.92	9.55	2.97	9.54	3.01	9.52	3.05	10
11	10.52	3.22	10.51	3.26	10.49	3.31	10.48	3.35	11
12	11.48	3.51	11.46	3.56	11.44	3.61	11.43	3.66	12
13	12.43	3.80	12.42	3.86	12.40	3.91	12.38	3.96	13
14	13.39	4.09	13.37	4.15	13.35	4.21	13.33	4.27	14
15	14.34	4.39	14.33	4.45	14.31	4.51	14.29	4.57	15
16	15.30	4.68	15.28	4.74	15.26	4.81	15.24	4.88	16
17	16.26	4.97	16.24	5.04	16.21	5.11	16.19	5.18	17
18	17.21	5.26	17.19	5.34	17.17	5.41	17.14	5.49	18
19	18.17	5.56	18.15	5.63	18.12	5.71	18.10	5.79	19
20	19.13	5.85	19.10	5.93	19.07	6.01	19.05	6.10	20
21	20.08	6.14	20.06	6.23	20.03	6.31	20.00	6.40	21
22	21.04	6.43	21.01	6.52	20.98	6.62	20.95	6.71	22
23	21.99	6.72	21.97	6.82	21.94	6.92	21.91	7.01	23
24	22.95	7.02	22.92	7.12	22.89	7.22	22.86	7.32	24
25	23.91	7.31	23.88	7.41	23.84	7.52	23.81	7.62	25
26	24.86	7.60	24.83	7.71	24.80	7.82	24.76	7.93	26
27	25.82	7.89	25.79	8.01	25.75	8.12	25.71	8.23	27
28	26.78	8.19	26.74	8.30	26.70	8.42	26.67	8.54	28
29	27.73	8.48	27.70	8.60	27.66	8.72	27.62	8.84	29
30	28.69	8.77	28.65	8.90	28.61	9.02	28.57	9.15	30
31	29.65	9.06	29.61	9.19	29.57	9.32	29.52	9.45	31
32	30.60	9.36	30.56	9.49	30.52	9.62	30.48	9.76	32
33	31.56	9.65	31.52	9.79	31.47	9.92	31.43	10.06	33
34	32.51	9.94	32.47	10.08	32.43	10.22	32.38	10.37	34
35	33.47	10.23	33.43	10.38	33.38	10.52	33.33	10.67	35
36	34.43	10.53	34.38	10.68	34.33	10.83	34.29	10.97	36
37	35.38	10.82	35.34	10.97	35.29	11.13	35.24	11.28	37
38	36.34	11.11	36.29	11.27	36.24	11.43	36.19	11:58	38
39	37.30	11.40	37.25	11.57	37.20	11.73	37.14	11.89	39
40	38.25	11.69	38.20	11.86	38.15	12.03	38.10	12.19	40
41	39.21	11.99	39.16	12.16	39.10	12.33	39.05	12.50	41
42	40.16	12.28	40.11	12.45	40.06	12.63	40.00	12.80	42
43	41.12	12.57	41.07	12.75	41.01	12.93	40.95	13.11	43
44	42.08	12.86	42.02	13.05	41.96	13 23	41.91	13.41	44
45	43.03	13.16	42.98	13.34	42.92	13.53	42.86	13.72	45
46	43.99	13.45	43.93	13.64	43.87	13.83	43.81	14.02	46
47	44.95	13.74	44.89	13.94	44.82	14.13	44.76	14.33	47
48	45.90	14.03	45.84	14.23	45.78	14.43	45.72	14.63	48
49	46.86	14.33	46.80	14.53	46.73	14.73	46.67	14.94	49
50	47.82	14.62	47.75	14.83	47.69	15.04	47.62	15.24	50
Loa.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Loa.
	73 deg. 0 min.		72 deg. 45 min.		72 deg. 30 min.		72 deg. 15 min.		

Loa.	18 deg. 0 min.		18 deg. 15 min.		18 deg. 30 min.		18 deg. 45 min.		Loa.
	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	
1	0.95	0.31	0.95	0.31	0.95	0.32	0.95	0.32	1
2	1.90	0.62	1.90	0.63	1.90	0.63	1.89	0.64	2
3	2.85	0.93	2.85	0.94	2.84	0.95	2.84	0.96	3
4	3.80	1.24	3.80	1.25	3.79	1.27	3.79	1.29	4
5	4.76	1.55	4.75	1.57	4.74	1.59	4.73	1.61	5
6	5.71	1.85	5.70	1.88	5.69	1.90	5.68	1.93	6
7	6.66	2.16	6.65	2.19	6.64	2.22	6.63	2.25	7
8	7.61	2.47	7.60	2.51	7.59	2.54	7.58	2.57	8
9	8.56	2.78	8.55	2.82	8.53	2.86	8.52	2.89	9
10	9.51	3.09	9.50	3.13	9.48	3.17	9.47	3.21	10
11	10.46	3.40	10.45	3.44	10.43	3.49	10.42	3.54	11
12	11.41	3.71	11.40	3.76	11.38	3.81	11.36	3.86	12
13	12.36	4.02	12.35	4.07	12.33	4.12	12.31	4.18	13
14	13.31	4.33	13.30	4.38	13.28	4.44	13.26	4.50	14
15	14.27	4.65	14.25	4.70	14.22	4.76	14.20	4.82	15
16	15.22	4.94	15.20	5.01	15.17	5.08	15.15	5.14	16
17	16.17	5.25	16.14	5.32	16.12	5.39	16.10	5.46	17
18	17.12	5.56	17.09	5.64	17.07	5.71	17.04	5.79	18
19	18.07	5.87	18.04	5.95	18.02	6.03	17.99	6.11	19
20	19.02	6.18	18.99	6.26	18.97	6.35	18.94	6.43	20
21	19.97	6.49	19.94	6.58	19.91	6.66	19.89	6.75	21
22	20.92	6.80	20.89	6.89	20.86	6.98	20.83	7.07	22
23	21.87	7.11	21.84	7.20	21.81	7.30	21.78	7.39	23
24	22.83	7.42	22.79	7.52	22.76	7.62	22.73	7.71	24
25	23.78	7.73	23.74	7.83	23.71	7.93	23.67	8.04	25
26	24.73	8.03	24.69	8.14	24.66	8.25	24.62	8.36	26
27	25.68	8.34	25.64	8.46	25.60	8.57	25.57	8.68	27
28	26.63	8.65	26.59	8.77	26.55	8.88	26.51	9.00	28
29	27.58	8.96	27.54	9.08	27.50	9.20	27.46	9.32	29
30	28.53	9.27	28.49	9.39	28.45	9.52	28.41	9.64	30
31	29.48	9.58	29.44	9.71	29.40	9.84	29.35	9.96	31
32	30.43	9.89	30.39	10.02	30.35	10.15	30.30	10.29	32
33	31.38	10.20	31.34	10.33	31.29	10.47	31.25	10.61	33
34	32.34	10.51	32.29	10.65	32.24	10.79	32.20	10.93	34
35	33.29	10.82	33.24	10.96	33.19	11.11	33.14	11.25	35
36	34.24	11.12	34.19	11.27	34.14	11.42	34.09	11.57	36
37	35.19	11.43	35.14	11.59	35.09	11.74	35.04	11.89	37
38	36.14	11.74	36.09	11.90	36.04	12.06	35.98	12.21	38
39	37.09	12.05	37.04	12.21	36.93	12.37	36.93	12.54	39
40	38.04	12.36	37.99	12.53	37.93	12.69	37.88	12.86	40
41	38.99	12.67	38.94	12.84	38.88	13.01	38.82	13.18	41
42	39.94	12.98	39.89	13.15	39.83	13.33	39.77	13.50	42
43	40.90	13.29	40.84	13.47	40.78	13.64	40.72	13.82	43
44	41.85	13.60	41.79	13.98	41.73	13.96	41.66	14.14	44
45	42.80	13.91	42.74	14.09	42.67	14.28	42.61	14.46	45
46	43.75	14.21	43.69	14.41	43.62	14.60	43.56	14.79	46
47	44.70	14.52	44.64	14.72	44.57	14.91	44.51	15.11	47
48	45.65	14.89	45.59	15.03	45.52	15.23	45.45	15.43	48
49	46.60	15.14	46.54	15.34	46.47	15.55	46.40	15.75	49
50	47.55	15.45	47.48	15.66	47.42	15.86	47.35	16.07	50
Loa.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Loa.
	72 deg. 0 min.		71 deg. 45 min.		71 deg. 30 min.		71 deg. 15 min.		

Loa.	19 deg. 0 min.		19 deg. 15 min.		19 deg. 30 min.		19 deg. 45 min.		Loa.
	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	
1	0.95	0.33	0.94	0.33	0.94	0.33	0.94	0.34	1
2	1.89	0.65	1.89	0.66	1.89	0.67	1.88	0.68	2
3	2.84	0.98	2.83	0.99	2.83	1.00	2.82	1.01	3
4	3.78	1.30	3.78	1.32	3.77	1.34	3.76	1.35	4
5	4.73	1.63	4.72	1.65	4.71	1.67	4.71	1.69	5
6	5.67	1.95	5.66	1.98	5.66	2.00	5.65	2.03	6
7	6.62	2.28	6.61	2.31	6.60	2.34	6.59	2.37	7
8	7.56	2.60	7.55	2.64	7.54	2.67	7.53	2.70	8
9	8.51	2.93	8.50	2.97	8.48	3.00	8.47	3.04	9
10	9.46	3.26	9.44	3.30	9.43	3.34	9.41	3.38	10
11	10.40	3.58	10.38	3.63	10.37	3.67	10.35	3.72	11
12	11.35	3.91	11.33	3.96	11.31	4.01	11.29	4.06	12
13	12.29	4.23	12.27	4.29	12.25	4.34	12.24	4.39	13
14	13.24	4.56	13 22	4.62	13.20	4.67	13.18	4.73	14
15	14.18	4.88	14.16	4.95	14.14	5.01	14.12	5.07	15
16	15.13	5.21	15.11	5.28	15.08	5.34	15.06	5.41	16
17	16.07	5.53	16.05	5.60	16.02	5.67	16.00	5.74	17
18	17.02	5.86	16.99	5.93	16.97	6.01	16.94	6.08	18
19	17.96	6.19	17.94	6.26	17.91	6.34	17.88	6.42	19
20	18.91	6.51	18.88	6.59	18.85	6.68	18.82	6.76	20
21	19.86	6.84	19.83	6.92	19.80	7.01	19.76	7.10	21
22	20.80	7.16	20.77	7.25	20.74	7.34	20.71	7.43	22
23	21.75	7.49	21.71	7.58	21.68	7.68	21.65	7.77	23
24	22.69	7.81	22.66	7.91	22.62	8.01	22.59	8.11	24
25	23.64	8.14	23.60	8.24	22.57	8.35	23.53	8.45	25
26	24.58	8.46	24.55	8.57	24.51	8.68	24.47	8.79	26
27	25.53	8.79	25.49	8.90	25.45	9.01	25.41	9.12	27
28	26.47	9.12	26.43	9.23	26.39	9.35	26.35	9.46	28
29	27.42	9.44	27.38	9.56	27.34	9.68	27.29	9.80	29
30	28.37	9.77	28.32	9.89	28.28	10.01	28.24	10.14	30
31	29.31	10.09	29.27	10.22	29.22	10.35	29.18	10.48	31
32	30.26	10.42	30.21	10.55	30.16	10.68	30.12	10.81	32
33	31.20	10.74	31.15	10.88	31.11	11.02	31.06	11.15	33
34	32.15	11.07	32.10	11.21	32.05	11.35	32.00	11.49	34
35	33.09	11.39	33.04	11.54	32.99	11.68	32.94	11.83	35
36	34.04	11.72	33.99	11.87	33.94	12.02	33.88	12.17	36
37	34.98	12.05	34.93	12.20	34.88	12.35	34.82	12.50	37
38	35.93	12.37	35.88	12.53	35.82	12.68	35.76	12.84	38
39	36.88	12.70	36.82	12.86	36.76	13.02	36.71	13.18	39
40	37.82	13.02	37.76	13.19	37.71	13.35	37.65	13.52	40
41	38.77	13.35	38.71	13.52	38.65	13.69	38.59	13.85	41
42	39.71	13.67	39.65	13.85	39.59	14.02	39.53	14.19	42
43	40.66	14.00	40.60	14.18	40.53	14.35	40.47	14.53	43
44	41.60	14.33	41.54	14.51	41.48	14.69	41.41	14.87	44
45	42.55	14.65	42.48	14.84	42.42	15.02	42.35	15.21	45
46	43.49	14.98	43.43	15.17	43.36	15.36	43.29	15.54	46
47	44.44	15.30	44.37	15.50	44.30	15.69	44.24	15.88	47
48	45.38	15.63	45.32	15.83	45.25	16.02	45.18	16.22	48
49	46.33	15.95	46.26	16.15	46.19	16.36	46.12	16.56	49
50	47.28	16.28	47.20	16.48	47.13	16.69	47.06	16.90	50
Loa.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Loa.
	71 deg. 0 min.		70 deg. 45 min.		70 deg. 30 min.		70 deg. 15 min.		

Loa.	20 deg. 0 min.		20 deg. 15 min.		20 deg. 30 min.		20 deg. 45 min.		Loa.
	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	
1	0.94	0.34	0.94	0.35	0.94	0.35	0.94	0.35	1
2	1.88	0.68	1.88	0.69	1.87	0.70	1.87	0.71	2
3	2.82	1.03	2.81	1.04	2.81	1.05	2.81	1.06	3
4	3.76	1.37	3.75	1.38	3.75	1.40	3.74	1.42	4
5	4.70	1.71	4.69	1.73	4.68	1.75	4.68	1.77	5
6	5.64	2.05	5.63	2.08	5.62	2.10	5.61	2.13	6
7	6.58	2.39	6.57	2.42	6.56	2.45	6.55	2.48	7
8	7.52	2.74	7.51	2.77	7.49	2.80	7.48	2.83	8
9	8.46	3.08	8.44	3.12	8.43	3.15	8.42	3.19	9
10	9.40	3.42	9.38	3.46	9.37	3.50	9.35	3.54	10
11	10.34	3.76	10.32	3.81	10.30	3.85	10.29	3.90	11
12	11.28	4.10	11 26	4.15	11.24	4.20	11.22	4.25	12
13	12.22	4.45	12.20	4.50	12.18	4.55	12.16	4.61	13
14	13.16	4.79	13.13	4.85	13.11	4.90	13.09	4.96	14
15	14.10	5.13	14.07	5.19	14.05	5.25	14.03	5 31	15
16	15.04	5.47	15.01	5.54	14.99	5.60	14.96	5.67	16
17	15.97	5.81	15.95	5.88	15.92	5.95	15.90	6.02	17
18	16.91	6 16	16.89	6.23	16.86	6.30	16.83	6.38	18
19	17.85	6.50	17.83	6.58	17.80	6.65	17.77	6.73	19
20	18.79	6.84	18.76	6 92	18.73	7.00	18.70	7.09	20
21	19.73	7.18	19.70	7.27	19.67	7.35	19.64	7.44	21
22	20.67	7.52	20.64	7 61	20.61	7.70	20.57	7.79	22
23	21.61	7.87	21.58	7.96	21.54	8.05	21.51	8.15	23
24	22.55	8.21	22.52	8.31	22.48	8.41	22.44	8.50	24
25	23.49	8.55	23.45	8.65	23.42	8.76	23.38	8.86	25
26	24.43	8.89	24.39	9.00	24.35	9.11	24.31	9.21	26
27	25.37	9.23	25.33	9.35	25.29	9.46	25.25	9 57	27
28	26.31	9.58	26.27	9.69	26.23	9.81	26.18	9.92	28
29	27.25	9.92	27.21	10.04	27.16	10.16	27.12	10.27	29
30	28.19	10.26	28.15	10.38	28.10	10.71	28.05	10.63	30
31	29.13	10.60	29.08	10.73	29.04	10.86	28.99	10.98	31
32	30.07	10.94	30.02	11.08	29.97	11.21	29.92	11.34	32
33	31.01	11.29	30.96	11.42	30.91	11.56	30.86	11.69	33
34	31.95	11.63	31.90	11.77	31.85	11.91	31.79	12.05	34
35	32 89	11.97	32.84	12.11	32.78	12.26	32.73	12.40	35
36	33.83	12.31	33.77	12.46	33.72	12.61	33.67	12.75	36
37	34.77	12.65	34.71	12.81	34.66	12.96	34.60	13.11	37
38	35.71	13.00	35.65	13.15	35.59	13.31	35.54	13.46	38
39	36.65	13.34	36.59	13.50	36.53	13.66	36.47	13.82	39
40	37.59	13.68	37.53	13.84	37.47	14.01	37.41	14.17	40
41	38.53	14.02	38.47	14.19	38.40	14.36	38.34	14.53	41
42	39.47	14.36	39.40	14.54	39.34	14.71	39.28	14.88	42
43	40.41	14.71	40.34	14.88	40.28	15.06	40.21	15.23	43
44	41.35	15.05	41.28	15.23	41.21	15.41	41.15	15.59	44
45	42.29	15.39	42.22	15.58	42.15	15.76	42.08	15.94	45
46	43.23	15.73	43.16	15.92	43.09	16.11	43.02	16.30	46
47	44.17	16.07	44.09	16.27	44.02	16.46	43.95	16.65	47
48	45.11	16.42	45.03	16.61	44.96	16.81	44.89	17.01	48
49	46.04	16.76	45.97	16.96	45.90	17.16	45.82	17.36	49
50	46.98	17.10	46.91	17.31	46.83	17.51	46.76	17.71	50
Loa.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Loa.
	70 deg.	0 min.	69 deg.	45 min.	69 deg.	30 min.	69 deg.	15 min.	

Lon.	21 deg. 0 min.		21 deg. 15 min.		21 deg. 30 min.		21 deg. 45 min.		Lon.
	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	
1	0.93	0.36	0.93	0.36	0.93	0.37	0.93	0.37	1
2	1.87	0.72	1.86	0.72	1.86	0.73	1.86	0.74	2
3	2.80	1.08	2.80	1.09	2.79	1.10	2.79	1.11	3
4	3.73	1.43	3.73	1.45	3.72	1.47	3.72	1.48	4
5	4.67	1.79	4.66	1.81	4.65	1.83	4.64	1.85	5
6	5.60	2.15	5.59	2.17	5.58	2.20	5.57	2.22	6
7	6.54	2.51	6.52	2.54	6.51	2.57	6.50	2.59	7
8	7.47	2.87	7.46	2.90	7.44	2.93	7.43	2.96	8
9	8.40	3.23	8.39	3.26	8.37	3.30	8.36	3.34	9
10	9.34	3.58	9.32	3.62	9.30	3.67	9.29	3.71	10
11	10.27	3.94	10.25	3.99	10.23	4.03	10.22	4.08	11
12	11.20	4.30	11.18	4.35	11.17	4.40	11.15	4.45	12
13	12.14	4.66	12.12	4.71	12.10	4.76	12.07	4.82	13
14	13.07	5.02	13.05	5.07	13.03	5.13	13.00	5.19	14
15	14.00	5.38	13.98	5.44	13.96	5.50	13.93	5.56	15
16	14.94	5.73	14.91	5.80	14.89	5.86	14.86	5.93	16
17	15.87	6.09	15.84	6.16	15.82	6.23	15.79	6.30	17
18	16.80	6.45	16.78	6.52	16.75	6.60	16.72	6.67	18
19	17.74	6.81	17.71	6.89	17.68	6.96	17.65	7.04	19
20	18.67	7.17	18.64	7.25	18.61	7.33	18.58	7.41	20
21	19.61	7.53	19.57	7.61	19.54	7.70	19.51	7.78	21
22	20.54	7.88	20.50	7.97	20.47	8.06	20.43	8.15	22
23	21.47	8.24	21.44	8.34	21.40	8.43	21.36	8.52	23
24	22.41	8.60	22.37	8.70	22.33	8.80	22.29	8.89	24
25	23.34	8.96	23.30	9.06	23.26	9.16	23.22	9.26	25
26	24.27	9.32	24.23	9.42	24.19	9.53	24.15	9.63	26
27	25.21	9.68	25.16	9.79	25.12	9.90	25.08	10.01	27
28	26.14	10.03	26.10	10.15	26.05	10.26	26.01	10.38	28
29	27.07	10.39	27.03	10.51	26.98	10.63	26.94	10.75	29
30	28.01	10.75	27.96	10.87	27.91	11.00	27.86	11.12	30
31	28.94	11.11	28.89	11.24	28.84	11.36	28.79	11.49	31
32	29.87	11.47	29.82	11.60	29.77	11.73	29.72	11.86	32
33	30.81	11.83	30.76	11.96	30.70	12.09	30.65	12.23	33
34	31.74	12.18	31.69	12.32	31.63	12.46	31.58	12.60	34
35	32.68	12.54	32.62	12.69	32.56	12.83	32.51	12.97	35
36	33.61	12.90	33.55	13.05	33.50	13.19	33.44	13.34	36
37	34.54	13.26	34.48	13.41	34.43	13.56	34.37	13.71	37
38	35.48	13.62	35.42	13.77	35.36	13.93	35.29	14.08	38
39	36.41	13.98	36.35	14.14	36.29	14.29	36.22	14.45	39
40	37.34	14.33	37.28	14.50	37.22	14.66	37.15	14.82	40
41	38.28	14.69	38.21	14.86	38.15	15.03	38.08	15.19	41
42	39.21	15.05	39.14	15.22	39.08	15.39	39.01	15.56	42
43	40.14	15.41	40.08	15.58	40.01	15.76	39.94	15.93	43
44	41.08	15.77	41.01	15.95	40.94	16.13	40.87	16.30	44
45	42.01	16.13	41.94	16.31	41.87	16.49	41.80	16.68	45
46	42.94	16.49	42.87	16.67	42.80	16.86	42.73	17.05	46
47	43.88	16.84	43.80	17.03	43.73	17.23	43.65	17.42	47
48	44.81	17.20	44.74	17.40	44.66	17.59	44.58	17.79	48
49	45.75	17.56	45.67	17.76	45.59	17.96	45.51	18.16	49
50	46.68	17.92	46.50	18.12	46.52	18.33	46.44	18.53	50
Lon.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.
	69 deg.	0 min.	68 deg.	45 min.	68 deg.	30 min.	68 deg.	15 min.	

Loa.	22 deg. 0 min.		22 deg. 15 min.		22 deg. 30 min.		22 deg. 45 min.		Loa.
	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	
1	0.93	0.37	0.93	0.38	0.92	0.38	0.92	0.39	1
2	1.85	0.75	1.85	0.76	1.85	0.77	1.84	0.77	2
3	2.78	1.12	2.78	1.14	2.77	1.15	2.77	1.16	3
4	3.71	1.50	3.70	1.51	3.70	1.53	3.69	1.55	4
5	4.64	1.87	4.63	1.89	4.62	1.91	4.61	1.93	5
6	5.56	2.25	5.55	2.27	5.54	2.30	5.53	2.32	6
7	6.49	2.62	6.48	2.65	6.47	2.68	6.46	2.71	7
8	7.42	3.00	7.40	3.03	7.39	3.06	7.38	3.09	8
9	8.34	3.37	8.33	3.41	8.31	3.44	8.30	3.48	9
10	9.27	3.75	9.26	3.79	9.24	3.83	9.22	3.87	10
11	10.20	4.12	10.18	4.17	10.16	4.21	10.14	4.25	11
12	11.13	4.50	11.11	4.54	11.09	4.59	11.07	4.64	12
13	12.05	4.87	12.03	4.92	12.01	4.97	11.99	5.03	13
14	12.98	5.24	12.96	5.30	12.93	5.36	12.91	5.41	14
15	13.91	5.62	13.88	5.68	13.86	5.74	13.83	5.80	15
16	14.83	5.99	14.81	6.06	14.78	6.12	14.76	6.19	16
17	15.76	6.37	15.73	6.44	15.71	6.51	15.68	6.57	17
18	16.69	6.74	16.66	6.82	16.63	6.89	16.60	6.96	18
19	17.62	7.12	17.59	7.19	17.55	7.27	17.52	7.35	19
20	18.54	7.49	18.51	7.57	18.48	7.65	18.44	7.73	20
21	19.47	7.87	19.44	7.95	19.40	8.04	19.37	8.12	21
22	20.40	8.24	20.36	8.33	20.33	8.42	20.29	8.51	22
23	21.33	8.62	21.29	8.71	21.25	8.80	21.21	8.89	23
24	22.25	8.99	22.21	9.09	22.17	9.18	22.13	9.28	24
25	23.18	9.37	23.14	9.47	23.10	9.57	23.06	9.67	25
26	24.11	9.74	24.06	9.84	24.02	9.95	23.98	10.05	26
27	25.03	10.11	24.99	10.22	24.94	10.33	24.90	10.44	27
28	25.96	10.49	25.92	10.60	25.87	10.72	25.82	10.83	28
29	26.89	10.86	26.84	10.98	26.79	11.10	26.74	11.21	29
30	27.82	11.24	27.77	11.36	27.72	11.48	27.67	11.60	30
31	28.74	11.61	28.69	11.74	28.64	11.86	28.59	11.99	31
32	29.67	11.99	29.62	12.12	29.56	12.25	29.51	12.37	32
33	30.60	12.36	30.54	12.50	30.49	12.63	30.43	12.76	33
34	31.52	12.74	31.47	12.87	31.41	13.01	31.35	13.15	34
35	32.45	13.11	32.39	13.25	32.34	13.39	32.28	13.53	35
36	33.38	13.49	33.32	13.63	33.26	13.78	33.20	13.92	36
37	34.31	13.86	34.24	14.01	34.18	14.16	34.12	14.31	37
38	35.23	14.24	35.17	14.39	35.11	14.54	35.04	14.69	38
39	36.16	14.61	36.10	14.77	36.03	14.92	35.97	15.08	39
40	37.09	14.98	37.02	15.15	36.96	15.31	36.89	15.47	40
41	38.01	15.36	37.95	15.52	37.88	15.69	37.81	15.86	41
42	38.94	15.73	38.87	15.90	38.80	16.07	38.73	16.24	42
43	39.87	16.11	39.80	16.28	39.73	16.46	39.65	16.63	43
44	40.80	16.48	40.72	16.66	40.65	16.84	40.58	17.02	44
45	41.72	16.86	41.65	17.04	41.57	17.22	41.50	17.40	45
46	42.65	17.23	42.57	17.42	42.50	17.60	42.42	17.79	46
47	43.58	17.61	43.50	17.80	43.42	17.69	43.34	18.18	47
48	44.50	17.98	44.43	18.18	44.35	18.37	44.27	18.56	48
49	45.43	18.36	45.35	18.55	45.27	18.75	45.19	18.95	49
50	46.36	18.73	46.28	18.93	46.19	19.13	46.11	19.34	50
Loa.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Loa.
	68 deg. 0 min.		67 deg. 45 min.		67 deg. 30 min.		67 deg. 15 min.		

Loa.	23 deg. 0 min.		23 deg. 15 min.		23 deg. 30 min.		23 deg. 45 min.		Loa.
	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	
1	0.92	0.39	0.92	0.39	0 92	0.40	0.92	0.40	1
2	1.84	0.78	1.84	0.79	1.83	0.80	1.83	0.81	2
3	2.76	1.17	2.76	1.18	2.75	1.20	2.75	1.21	3
4	3.68	1.56	3.68	1.58	3.67	1.60	3.66	1.61	4
5	4.60	1.95	4.59	1.97	4.59	1.99	4.58	2.01	5
6	5.52	2.34	5.51	2.37	5.50	2.39	5.49	2.42	6
7	6.44	2.74	6.43	2.76	6.42	2.79	6.41	2.82	7
8	7.36	3.13	7.35	3.16	7.34	3.19	7.32	3.22	8
9	8.28	3.52	8.27	3.55	8.25	3.59	8.24	3.62	9
10	9.21	3.91	9.10	3.95	9.17	3.99	9.15	4.03	10
11	10.13	4.30	10.11	4.34	10.09	4.39	10.07	4.43	11
12	11.05	4.69	11.03	4.74	11.00	4.79	10.98	4.83	12
13	11.97	5.08	11.94	5.13	11.92	5.18	11.90	5.24	13
14	12.89	5.47	12.86	5.53	12.84	5.58	12.81	5.64	14
15	13.81	5.86	13.78	5.92	13.76	5.98	13.73	6.04	15
16	14.73	6.25	14.70	6.32	14.67	6.38	14.64	6.44	16
17	15.65	6.64	15.62	6.71	15.59	6.78	15.56	6.85	17
18	16.57	7.03	16.54	7.11	16.51	7.18	16.48	7.25	18
19	17.49	7.42	17.46	7.50	17.42	7.58	17.39	7.65	19
20	18.41	7.81	18.38	7 89	18.34	7.98	18.31	8.06	20
21	19.33	8.21	19.29	8.29	19.26	8.37	19.22	8.46	21
22	20.25	8.60	20.21	8.68	20.18	8.77	20.14	8.86	22
23	21.17	8.99	21.13	9.08	21.09	9.17	21.05	9.26	23
24	22.09	9.38	22.05	9.47	22.01	9.57	21.97	9.67	24
25	23.01	9.77	22.97	9.87	22.93	9.97	22.88	10.07	25
26	23.93	10.16	23.89	10.26	23.84	10.37	23.80	10.47	26
27	24.85	10.55	24.81	10.66	24.76	10.77	24.71	10.87	27
28	25.77	10.94	25.73	11.05	25.68	11.16	25.63	11.28	28
29	26.69	11.33	26.64	11.45	26.59	11.56	26.54	11.68	29
30	27.62	11.72	27.56	11.84	27.51	11.96	27.46	12.08	30
31	28.54	12.11	28.48	12.24	28.43	12.36	28.37	12.49	31
32	29.46	12.50	29.40	12.63	29.35	12.76	29.29	12.89	32
33	30.38	12.89	30.32	13.03	30.26	13.16	30.21	13.29	33
34	31.30	13.28	31.24	13.42	31.18	13.56	31.12	13.69	34
35	32.22	13.68	32.16	13.82	32.10	13.96	32.04	14.10	35
36	33.14	14.07	33.08	14.21	33.01	14.36	32.95	14.50	36
37	34.06	14.46	34.00	14.61	33.93	14.75	33.87	14.90	37
38	34.98	14.85	34.91	15.00	34.85	15.15	34.78	15.30	38
39	35.90	15.24	35.83	15.39	35.77	15.55	35.70	15.71	39
40	36.82	15.63	36.75	15.79	36.68	15.95	36.61	16.11	40
41	37.74	16.02	37.67	16.18	37.60	16.35	37.53	16.51	41
42	38.66	16.41	38.59	16.58	38.52	16.75	38.44	16.92	42
43	39.58	16.80	39.51	16.97	39.43	17.15	39.36	17.32	43
44	40.50	17.19	40.43	17.37	40.35	17.54	40.27	17.72	44
45	41.42	17.58	41.35	17.76	41.27	17.94	41.19	18.12	45
46	42.34	17.97	42.26	18.16	42.18	18.34	42.10	18.53	46
47	43.26	18.36	43.18	18.55	43.10	18.74	43.02	18.93	47
48	44.18	18.76	44.10	18.95	44.02	19.14	43.93	19.33	48
49	45.10	19.15	45.02	19.34	44.94	19.54	44.85	19.73	49
50	46.03	19.54	45.94	19.74	45.85	19.94	45.77	20 14	50
Loa.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Loa.
	67 deg. 0 min.		66 deg. 45 min.		66 deg. 30 min.		66 deg. 15 min.		

Loa.	24 deg. 0 min.		24 deg. 15 min.		24 deg. 30 min.		24 deg. 45 min.		Loa.
	Lat	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	
1	0.91	0.41	0.91	0.41	0.91	0.41	0.91	0.42	1
2	1.83	0.81	1 82	0 82	1.82	0.83	1.82	0.84	2
3	2.74	1 22	2.74	1.23	2.73	1.24	2.72	1.26	3
4	3.65	1.63	3.65	1.64	3.64	1.66	3.63	1.67	4
5	4.57	2.03	4.56	2 05	4.55	2 07	4.54	2.09	5
6	5.48	2.44	5.47	2.46	5.46	2.49	5.45	2.51	6
7	6.39	2.85	6.38	2.88	6.37	2.90	6 36	2.93	7
8	7.31	3.25	7.29	3.29	7.28	3.32	7.27	3.35	8
9	8.22	3.66	8.21	3 70	8.19	3.73	8 17	3.77	9
10	9.14	4.07	9.12	4.11	9.10	4.15	9.08	4.19	10
11	10.05	4.47	10.03	4 52	10.01	4.56	9.99	4.61	11
12	10.96	4.88	10.94	4.93	10.92	4.98	10.90	5.02	12
13	11.88	5.29	11.85	5.34	11.83	5.39	11.81	5.44	13
14	12.79	5.69	12.76	5.75	12.74	5.81	12.71	5.86	14
15	13.70	6.10	13.68	6.16	13.65	6.22	13.62	6.28	15
16	14.62	6.51	14 59	6.57	14.56	6.64	14.53	6.70	16
17	15.53	6.91	15.50	6 98	15.47	7.05	15.44	7.12	17
18	16 44	7.32	16.41	7.39	16.38	7.46	16.35	7.54	18
19	17.36	7.73	17.32	7.80	17.29	7.88	17.25	7.95	19
20	18.27	8.13	18.24	8.21	18.20	8.29	18.16	8.37	20
21	19.18	8 54	19.15	8.63	19.11	8 71	19.07	8.79	21
22	20.10	8.95	20.06	9.04	20.02	9.12	19.98	9.21	22
23	21.01	9.36	20.97	9.45	20.93	9.54	20.89	9.63	23
24	21.93	9.76	21.88	9.86	21.84	9.95	21.80	10.05	24
25	22.84	10.17	22.79	10.27	22.75	10.37	22.70	10.47	25
26	23.75	10.58	23.71	10.68	23.66	10.78	23.61	10.89	26
27	24.67	10.98	24.62	11 09	24.57	11.20	24.52	11.30	27
28	25.58	11.39	25 53	11.50	25.48	11.61	25.43	11.72	28
29	26 49	11.80	26 44	11.91	26.39	12.03	26.34	12.14	29
30	27.41	12.20	27.35	12.32	27.30	12.44	27.24	12.56	30
31	28.32	12.61	28.26	12.73	28.21	12 86	28.15	12.98	31
32	29.23	13.02	29.18	13.14	29.12	13.27	29.06	13.40	32
33	30.15	13.42	30.09	13.55	30.03	13.68	29.97	13.82	33
34	31.06	13.83	31.00	13.96	30.94	14 10	30.88	14.23	34
35	31.97	14.24	31.91	14.38	31.85	14.51	31.78	14.65	35
36	32.89	14.64	32.82	14.79	32 76	14.93	32.69	15.07	36
37	33.80	15.05	33.74	15.20	33.67	15.34	33.60	15.49	37
38	34.71	15.46	34.65	15.61	34.58	15.76	34.51	15.91	38
39	35.63	15.86	35.56	16.02	35.49	16.17	35.42	16.33	39
40	36.54	16.27	36.47	16.43	36.40	16.59	36.33	16.75	40
41	37.46	16.68	37.38	16.84	37.31	17.00	37.23	17.17	41
42	38.37	17.08	38.29	17.25	38.22	17.42	38.14	17.58	42
43	39.28	17.49	39.21	17 66	39.13	17.83	39 05	18.00	43
44	40.20	17.90	40.12	18.07	40.04	18.25	39.96	18 42	44
45	41.11	18.30	41.03	18.48	40.95	18.66	40.87	18.84	45
46	42.02	18.71	41.94	18.89	41.86	19.08	41.77	19.26	46
47	42.94	19.12	42.85	19.30	42.77	19.49	42.68	19.68	47
48	43.85	19.52	43.76	19 71	43.68	19.91	43.59	20.10	48
49	44.76	19.93	44.68	20.13	44.59	20.32	44.50	20.52	49
50	45.68	20.34	45.59	20.54	45.50	20.73	45.41	20.93	50
Loa.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Loa.
	66 deg.	0 min.	65 deg.	45 min.	65 deg.	30 min.	65 deg.	15 min.	

Loa.	25 deg. 0 min.		25 deg. 15 min.		25 deg. 30 min.		25 deg. 45 min.		Loa.
	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	
1	0.91	0.42	0.90	0.43	0.90	0.43	0.90	0.43	1
2	1.81	0.85	1.81	0.85	1.81	0.86	1.80	0.87	2
3	2.72	1.27	2.71	1.28	2.71	1.29	2.70	1 30	3
4	3.63	1.69	3.62	1.71	3.61	1.72	3.60	1.74	4
5	4.53	2.11	4.52	2.13	4.51	2.15	4.50	2.17	5
6	5.44	2.54	5.43	2.56	5.42	2.58	5.40	2.61	6
7	6.34	2.96	6.33	2.99	6.32	3.01	6.30	3.04	7
8	7.25	3.38	7.24	3.41	7.22	3.44	7.21	3.48	8
9	8.16	3.80	8.14	3.84	8.12	3.87	8.11	3.91	9
10	9.06	4.23	9.04	4.27	9.03	4.31	9.01	4.34	10
11	9.97	4.65	9.95	4.69	9.93	4.74	9.91	4.78	11
12	10.88	5.07	10.85	5.12	10.83	5.17	10.81	5.21	12
13	11.78	5.49	11.76	5.55	11.73	5.60	11.71	5.65	13
14	12.69	5.92	12.66	5.97	12.64	6.03	12.61	6.08	14
15	13.59	6.34	13.57	6.40	13.54	6.46	13.51	6.52	15
16	14.50	6.76	14.47	6.83	14.44	6.89	14.41	6.95	16
17	15.41	7.18	15.38	7.25	15.34	7.32	15.31	7.39	17
18	16.31	7.61	16.28	7.68	16.25	7.75	16.21	7.82	18
19	17.22	8.03	17.18	8.10	17.15	8.18	17.11	8.25	19
20	18.13	8.45	18.09	8.53	18.05	8.61	18.01	8.69	20
21	19.03	8.88	18.99	8.96	18.95	9.04	18.91	9 12	21
22	19.94	9.30	19.90	9.38	19.86	9.47	19.82	9.56	22
23	20.85	9.72	20.80	9.81	20.76	9.90	20.72	9.99	23
24	21.75	10.14	21.71	10.24	21.66	10.33	21.62	10.43	24
25	22.66	10.57	22.61	10.66	22.56	10.76	22.52	10.86	25
26	23.56	10.99	23.52	11.09	23.47	11.19	23.42	11.30	26
27	24.47	11.41	24.42	11.52	24.37	11.62	24.32	11.73	27
28	25.38	11.83	25.32	11.94	25.27	12.05	25.22	12.16	28
29	26.28	12.26	26.23	12.37	26.18	12.48	26.12	12.60	29
30	27.19	12.68	27.13	12.80	27.08	12.92	27.02	13.03	30
31	28.10	13.10	28.04	13.22	27.98	13.35	27.92	13.47	31
32	29 00	13.52	28.94	13.65	28.88	13.78	28.82	13.90	32
33	29.91	13.95	29.85	14.08	29.79	14.21	29.72	14.34	33
34	30.81	14.37	30.75	14.50	30.69	14.64	30.62	14.77	34
35	31.72	14.79	31.66	14.93	31.59	15.07	31.52	15.21	35
36	32.63	15.21	32.56	15.36	32.49	15.50	32.43	15.64	36
37	33.53	15.64	33.47	15.78	33.40	15.93	33.33	16.07	37
38	34.44	16.06	34.37	16.21	34.30	16.36	34.23	16.51	38
39	35.35	16.48	35.27	16.64	35.20	16.79	35.13	16.94	39
40	36.25	16.90	36.18	17.06	36.10	17.22	36.03	17.38	40
41	37.16	17.33	37.08	17.49	37.01	17.65	36.93	17 81	41
42	38.07	17.76	37.99	17.92	37.91	18.08	37.83	18.25	42
43	38.97	18.17	38.89	18.34	38.81	18.51	38.73	18.68	43
44	39.88	18.60	39.80	18.77	39.71	18.94	39.63	19.12	44
45	40.78	19.02	40.70	19.20	40.62	19.37	40.53	19.55	45
46	41.69	19.44	41.61	19.62	41.52	19.80	41.43	19.98	46
47	42.60	19.86	42.51	20.05	42.42	20.23	42.33	20.42	47
48	43.50	20.29	43.41	20.48	43.32	20.66	43.23	20.85	48
49	44.41	20.71	44.32	20.90	44.23	21.09	44.13	21.29	49
50	45.32	21.13	55.22	21.33	45.13	21.53	45.03	21.72	50
Loa.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Loa.
	65 deg.	0 min.	64 deg.	45 min.	64 deg.	30 min.	64 deg.	15 min.	

Loa.	26 deg. 0 min.		26 deg. 15 min.		26 deg. 30 min.		26 deg. 45 min.		Loa.
	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	
1	0.90	0.44	0.90	0.44	0.89	0.45	0.89	0.45	1
2	1.80	0.88	1.79	0.88	1.79	0.89	1.79	0.90	2
3	2.70	1.32	2.69	1.33	2 68	1.34	2.68	1.35	3
4	3 60	1.75	3.59	1.77	3.58	1.78	3.57	1.80	4
5	4.49	2.19	4.48	2.21	4.47	2.23	4.46	2.25	5
6	5.39	2.63	5.38	2.65	5.37	2.68	5.36	2.70	6
7	6 29	3.07	6.28	3.10	6.26	3.12	6.25	3.15	7
8	7.19	3.51	7.17	3.54	7.16	3.57	7.14	3.60	8
9	8.09	3.95	8 07	3.98	8.05	4.02	8.04	4.05	9
10	8.99	4.38	8.97	4.42	8.95	4.46	8.93	4.50	10
11	9.89	4.82	9.87	4.87	9.84	4.91	9.82	4.95	11
12	10.79	5.26	10.76	5.31	10.74	5.35	10.72	5.40	12
13	11.68	5.70	11.66	5.75	11.63	5.80	11.61	5.85	13
14	12.58	6.14	12.56	6.19	12.53	6.25	12.50	6.30	14
15	13.48	6.58	13.45	6.63	13.42	6.69	13.39	6.75	15
16	14.38	7.01	14.35	7.08	14.32	7.14	14.29	7.20	16
17	15.28	7.45	15.25	7.52	15.21	7.59	15.18	7.65	17
18	16.18	7.89	16.14	7.96	16.11	8.03	16.07	8.10	18
19	17.08	8.33	17.04	8.40	17.00	8.48	16.97	8.55	19
20	17.98	8.77	17.94	8.85	17.90	8.92	17.86	9.00	20
21	18.87	9.21	18.83	9.29	18.79	9.37	18.75	9.45	21
22	19.77	9.64	19.73	9.73	19.69	9.82	19.65	9.90	22
23	20.67	10.08	20.63	10.17	20.58	10.26	20.54	10.35	23
24	21.57	10.52	21.52	10 61	21.48	10.71	21.43	10.80	24
25	22.47	10.96	22.42	11.06	22.37	11.16	22.32	11.25	25
26	23.37	11.40	23.32	11.50	23.27	11.60	23.22	11.70	26
27	24.27	11.84	24.22	11.94	24.16	12.05	24.11	12.15	27
28	25.17	12.27	25.11	12.38	25.06	12.49	25.00	12.60	28
29	26.06	12.71	26.01	12.83	25.95	12.94	25.90	13.05	29
30	26.96	13.15	26.91	13.27	26.85	13.39	26.79	13.50	30
31	27.86	13.59	27.80	13.71	27.74	13.83	27.68	13.95	31
32	28.76	14.03	28.70	14.15	28.64	14.28	28.58	14.40	32
33	29.66	14.47	29.60	14.60	29.53	14.72	29.47	14.85	33
34	30.56	14.90	30.49	15.04	30.43	15.17	30.36	15.30	34
35	31.46	15.34	31.39	15.48	31.32	15.62	31.25	15.75	35
36	32.36	15.78	32.29	15.92	32.22	16.06	32.15	16.20	36
37	33.26	16.22	33.18	16.36	33.11	16.51	33.04	16.65	37
38	34.15	16 66	34.08	16.81	34.01	16.96	33.93	17.10	38
39	35.05	17.10	34.98	17.25	34.90	17.40	34.83	17.55	39
40	35.95	17.53	35.87	17.69	35.80	17.85	35.72	18.00	40
41	36.85	17.97	36.77	18.13	36.69	18.29	36.61	18.45	41
42	37.75	18.41	37.67	18.58	37.59	18.74	37.51	18.90	42
43	38.65	18.85	38.57	19.02	38.48	19.19	38.40	19.35	43
44	39.55	19.29	39.46	19.46	39.38	19.63	39.29	19.80	44
45	40.45	19.73	40.36	19.90	40.27	20.08	40.18	20.25	45
46	41.34	20.17	41.26	20.35	41.17	20.53	41.08	20.70	46
47	42.24	20.60	42.15	20.79	42.06	20.97	41.97	21.15	47
48	43.14	21.04	43.05	21.23	42.96	21.42	42.86	21.60	48
49	44.04	21.48	43.95	21.67	43.85	21.86	43.76	22.05	49
50	44.94	21.92	44.84	22.11	44.75	22.31	44.65	22.51	50
Loa.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Loa.
	64 deg. 0 min.		63 deg. 45 min.		63 deg. 30 min.		63 deg. 15 min.		

Loa.	27 deg. 0 min.		27 deg. 15 min.		27 deg. 30 min.		27 deg. 45 min.		Loa.
	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	
1	0.83	0.45	0 89	0.46	0.89	0.46	0.88	0.47	1
2	1.78	0.91	1.78	0.92	1.77	0.92	1.77	0.93	2
3	2.67	1.36	2.67	1.37	2.66	1.39	2.65	1.40	3
4	3.56	1.82	3.56	1.83	3.55	1.85	3.54	1.86	4
5	4.46	2.27	4.45	2.29	4.44	2.31	4.42	2.33	5
6	5.35	2.72	5.33	2.75	5.32	2.77	5.31	2.79	6
7	6.24	3.18	6.22	3.21	6.21	3.23	6.19	3.26	7
8	7.13	3.63	7.11	3.66	7.10	3.69	7.08	3.72	8
9	8.02	4.09	8.00	4.12	7.98	4.16	7.96	4.19	9
10	8.91	4.54	8.89	4.58	8.87	4.62	8.85	4.66	10
11	9.80	4.99	9.78	5.04	9.76	5.08	9.73	5.12	11
12	10.69	5.45	10.67	5.49	10.64	5.54	10.62	5.59	12
13	11.58	5.90	11.56	5.95	11.53	6.00	11.50	6.05	13
14	12.47	6.36	12.45	6.41	12.42	6.46	12.39	6.52	14
15	13.37	6.81	13.34	6.87	13.31	6.93	13.27	6.98	15
16	14.26	7.26	14.22	7.33	14.19	7.39	14.16	7.45	16
17	15.15	7.72	15.11	7.78	15.08	7.85	15.04	7.92	17
18	16.04	8.17	16.00	8.24	15.97	8.31	15.93	8.38	18
19	16.93	8.63	16.89	8.70	16.85	8.77	16.81	8.85	19
20	17.82	9.08	17.78	9.16	17.74	9.23	17.70	9.31	20
21	18.71	9.53	18.67	9.62	18.63	9.70	18.58	9.78	21
22	19.60	9.99	19.56	10.07	19.51	10.16	19.47	10.24	22
23	20.49	10.44	20.45	10.53	20.40	10.62	20.35	10.71	23
24	21.38	10.90	21.34	10.99	21.29	11.08	21.24	11.17	24
25	22.28	11.35	22.23	11.45	22.18	11.54	22.12	11.64	25
26	23.17	11.80	23.11	11.90	23.06	12.01	23.01	12.11	26
27	24.06	12.26	24.00	12.36	23.95	12.47	23.89	12.57	27
28	24.95	12.71	24.89	12.82	24.84	12.93	24.78	13.04	28
29	25.84	13.17	25.78	13.28	25.72	13.39	25.66	13.50	29
30	26.73	13.62	26.67	13.74	26.61	13.85	26.55	13.97	30
31	27.62	14.07	27.56	14.19	27.50	14.31	27.43	14.43	31
32	28.51	14.53	28.45	14.65	28 38	14.78	28.32	14.90	32
33	29.40	14.98	29.34	15.11	29.27	15.24	29.20	15.37	33
34	30.29	15.44	30.23	15.57	30.16	15.70	30.09	15.83	34
35	31.19	15.89	31.12	16.03	31.05	16.16	30.97	16.30	35
36	32.08	16.34	32.00	16.48	31.93	16.62	31.86	16.76	36
37	32.97	16.80	32.89	16.94	32.82	17.08	32.74	17.23	37
38	33.86	17.25	33.78	17.40	33.71	17.55	33.63	17.69	38
39	34.75	17.71	34.67	17.86	34.59	18.01	34.51	18.16	39
40	35.64	18.16	35.56	18.31	35.48	18.47	35.40	18.62	40
41	36.53	18.61	36.45	18.77	36.37	18.93	36.28	19.09	41
42	37.42	19.07	37.34	19.23	37.25	19.39	37.17	19.56	42
43	38.31	19.52	38.23	19.69	38.14	19.86	38.05	20.02	43
44	39.20	19.98	39.12	20.15	39.03	20.32	38.94	20.49	44
45	40.10	20.43	40.01	20.60	39.92	20.78	39.82	20.95	45
46	40.99	20.88	40.89	21.06	40.80	21.24	40.71	21.42	46
47	41.88	21.34	41.78	21.52	41.69	21.70	41.59	21.88	47
48	42.77	21.79	42.67	21.98	42.58	22.16	42.48	22.35	48
49	43.66	22.25	43.56	22.44	43.46	22.63	43.36	22.81	49
50	44.55	22.70	44.45	22.89	44.35	23.09	44.25	23.28	50
Loa.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Loa.
	63 deg.	0 min.	62 deg.	45 min.	62 deg.	30 min.	62 deg.	15 min.	

Loa.	23 deg. 0 min.		28 deg. 15 min.		28 deg. 30 min.		28 deg. 45 min.		Loa.
	Lat	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	
1	0.88	0.47	0.88	0.47	0.88	0 48	0.88	0.48	1
2	1.77	0.94	1.76	0.95	1.76	0.95	1.75	0.96	2
3	2.65	1.41	2.64	1.42	2.64	1 43	2.63	1.44	3
4	3.53	1.88	3.52	1.89	3.52	1.91	3.51	1.92	4
5	4.41	2.35	4.40	2.37	4.39	2.39	4.38	2.40	5
6	5.30	2.82	5.29	2.84	5.27	2.86	5.26	2.89	6
7	6.18	3.29	6.17	3.31	6.15	3.34	6.14	3.37	7
8	7.06	3.76	7.05	3.79	7.03	3 82	7.01	3.85	8
9	7.95	4.23	7.93	4.26	7.91	4.29	7.89	4.33	9
10	8.83	4.69	8.81	4.73	8.79	4.77	8.77	4.81	10
11	9.71	5.16	9 69	5.21	9.67	5.25	9.64	5.29	11
12	10.60	5.63	10.57	5.68	10 55	5.73	10.52	5.77	12
13	11.48	6.10	11.45	6.15	11.42	6.20	11.40	6.25	13
14	12.36	6.57	12.33	6.63	12.30	6 68	12.27	6.73	14
15	13 24	7.04	13.21	7.10	13.18	7.16	13.15	7.21	15
16	14.13	7.51	14.09	7.57	14.06	7.63	14.03	7.70	16
17	15.01	7.98	14.98	8.05	14.94	8.11	14.90	8.18	17
18	15.89	8.45	15.86	8.52	15.82	8.59	15.78	8.66	18
19	16.78	8.92	16.74	8.99	16.70	9.07	16.66	9.14	19
20	17 66	9.39	17 62	9 47	17.58	9 54	17.53	9.62	20
21	18.54	9.86	18.50	9.94	18.46	10.02	18.41	10.10	21
22	19.42	10.33	19.38	10.41	19.33	10.50	19.29	10.58	22
23	20.31	10.80	20.26	10.89	20.21	10.97	20.16	11.06	23
24	21.19	11.27	21.14	11.36	21.09	11.45	21.04	11.54	24
25	22.07	11.74	22.02	11.83	21.97	11.93	21 92	12.02	25
26	22.96	12.21	22.90	12.31	22 85	12.41	22.79	12.51	26
27	23.84	12.68	23.78	12.78	23.73	12.88	23.67	12.99	27
28	24.72	13.15	24.66	13.25	24.61	13.36	24.55	13.47	28
29	25.61	13.61	25.55	13.73	25 49	13.84	25.43	13.95	29
30	26.49	14.08	26.43	14.20	26.36	14.31	26.30	14.43	30
31	27.37	14.55	27.31	14.67	27.24	14 79	27.18	14.91	31
32	28 25	15.02	28.19	15.15	28.12	15.27	28.06	15.39	32
33	29.14	15.49	29.07	15 62	29.00	15.75	28.93	15.87	33
34	30.02	15.96	29.95	16.09	29.88	16.22	29.81	16.35	34
35	30.90	16.43	30.83	16.57	30.76	16.70	30.69	16.83	35
36	31.79	16.90	31.71	17.04	31.64	17.18	31.56	17.32	36
37	32.67	17.37	32.59	17.51	32.52	17.65	32.44	17.80	37
38	33.55	17.84	33.47	17.99	33.40	18.13	33.32	18.28	38
39	34.44	18.31	34.35	18.46	34.27	18.61	34.19	18.76	39
40	35.32	18.78	35.24	18.93	35.15	19.09	35.07	19.24	40
41	36.20	19.25	36.12	19.41	36.03	19.56	35.95	19.72	41
42	37.08	19.72	37.00	19.88	36.91	20.04	36.82	20.20	42
43	37.97	20.19	37.88	20.35	37.79	20.52	37.70	20.68	43
44	38.85	20.66	38.76	20.83	38.67	21.00	38.58	21.16	44
45	39.73	21.13	39.64	21.30	39.55	21.47	39.45	21.64	45
46	40.62	21.60	40.52	21.77	40.43	21.95	40.33	22.13	46
47	41.50	22.07	41 40	22.25	41.30	22.43	41.21	22.61	47
48	42.38	22.53	42.28	22.72	42.18	22.90	42.08	23.09	48
49	43.26	23.00	43.16	23.19	43.06	23.38	42.96	23.57	49
50	44.15	23.47	44.04	23.67	43.94	23.86	43.84	24.05	50
Loa.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Loa.
	62 deg.	0 min.	61 deg.	45 min.	61 deg.	30 min.	61 deg.	15 min.	

Loa.	29 deg. 0 min.		29 deg. 15 min.		29 deg. 30 min.		29 deg. 45 min.		Loa.
	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	
1	0.87	0.48	0.87	0.49	0.87	0.49	0.87	0.50	1
2	1.75	0.97	1.75	0.98	1.74	0.98	1.74	0.99	2
3	2.62	1.45	2.62	1.47	2.61	1.48	2.60	1.49	3
4	3.50	1.94	3.49	1.95	3.48	1.97	3.47	1.98	4
5	4.37	2.42	4.36	2.44	4.35	2.46	4.34	2.48	5
6	5.25	2.91	5.24	2.93	5.22	2.95	5.21	2.98	6
7	6.12	3.39	6.11	3.42	6.09	3.45	6.08	3.47	7
8	7.00	3.88	6.98	3.91	6.96	3.94	6.95	3.97	8
9	7.87	4.36	7.85	4.40	7.83	4.43	7.81	4.47	9
10	8.75	4.85	8.73	4.89	8.70	4.92	8.68	4.96	10
11	9.62	5.33	9.60	5.37	9.57	5.42	9.55	5.46	11
12	10.50	5.82	10.47	5.86	10.44	5.91	10.42	5.95	12
13	11.37	6.30	11.34	6.35	11.31	6.40	11.29	6.45	13
14	12.24	6.79	12.22	6.84	12.19	6.89	12.15	6.95	14
15	13.12	7.27	13.09	7.33	13.06	7.39	13.02	7.44	15
16	13.99	7.76	13.96	7.82	13.93	7.88	13.89	7.94	16
17	14.87	8.24	14.83	8.31	14.80	8.37	14.76	8.44	17
18	15.74	8.73	15.71	8.80	15.67	8.86	15.63	8.93	18
19	16.62	9.21	16.58	9.28	16.54	9.36	16.50	9.43	19
20	17.49	9.70	17.45	9.77	17.41	9.85	17.36	9.92	20
21	18.37	10.18	18.32	10.26	18.28	10.34	18.23	10.42	21
22	19.24	10.67	19.20	10.75	19.15	10.83	19.10	10.92	22
23	20.12	11.15	20.07	11.24	20.02	11.33	19.97	11.41	23
24	20.99	11.64	20.94	11.73	20.89	11.82	20.84	11.91	24
25	21.87	12.12	21.81	12.22	21.76	12.31	21.70	12.41	25
26	22.74	12.61	22.69	12.70	22.63	12.80	22.57	12.90	26
27	23.61	13.09	23.56	13.19	23.50	13.30	23.44	13.40	27
28	24.49	13.57	24.43	13.68	24.37	13.79	24.31	13.89	28
29	25.36	14.06	25.30	14.17	25.24	14.28	25.18	14.39	29
30	26.24	14.54	26.18	14.66	26.11	14.77	26.05	14.89	30
31	27.11	15.03	27.05	15.15	26.98	15.27	26 91	15.38	31
32	27 99	15.51	27.92	15.64	27.85	15.76	27.78	15.88	32
33	28.86	16.00	28.79	16.12	28.72	16.25	28.65	16.38	33
34	29.74	16.48	29.67	16.61	29.59	16.74	29.52	16.87	34
35	30.61	16.97	30.54	17.10	30 46	17.23	30.39	17.37	35
36	31.49	17.45	31.41	17.59	31.33	17.73	31.26	17.86	36
37	32.36	17.94	32.28	18.08	32.20	18.22	32.12	18.36	37
38	33.24	18.42	33.16	18.57	33.07	18.71	32.99	18.86	38
39	34.11	18.91	34.03	19.06	33.94	19.20	33.86	19.35	39
40	34.98	19.39	34.90	19.54	34.81	19.70	34.73	19.85	40
41	35.86	19.88	35.77	20.03	35.68	20.19	35.60	20.35	41
42	36.73	20.36	36.65	20.52	36.56	20.68	36.46	20.84	42
43	37.61	20.85	37.52	21.01	37.43	21.17	37.33	21.34	43
44	38.48	21.33	38.39	21.50	38.30	21.67	38.20	21.83	44
45	39.36	21.82	39.26	21.99	39.17	22.16	39.07	22.33	45
46	40.22	22.30	40.14	22.48	40.04	22.65	39.94	22.83	46
47	41.11	22.79	41.01	22.97	40.91	23.14	40.81	23.32	47
48	41.98	23.27	41.88	23.45	41.78	23.64	41.67	23.82	48
49	42.86	23.76	42.75	23.94	42.65	24.13	42.54	24.31	49
50	43.73	24.24	43.63	24.43	43.52	24.62	43.41	24.81	50
Loa.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Loa.
	61 deg. 0 min.		60 deg. 45 min.		60 deg. 30 min.		60 deg. 15 min.		

Loa.	30 deg. 0 min.		30 deg. 15 min.		30 deg. 30 min.		30 deg. 45 min.		Loa.
	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	
1	0.87	0.50	0.86	0.50	0.86	0.51	0.86	0.51	1
2	1.73	1.00	1.73	1.01	1.72	1.02	1.72	1.02	2
3	2.60	1.50	2.59	1.51	2.58	1.52	2.58	1.53	3
4	3.46	2.00	3.46	2.02	3.45	2.03	3.44	2.05	4
5	4.33	2.50	4.32	2.52	4.31	2.54	4.30	2.56	5
6	5.20	3.00	5.18	3.02	5.17	3.05	5.16	3.07	6
7	6.06	3.50	6.05	3.53	6.03	3.55	6.02	3.58	7
8	6.93	4.00	6.91	4.03	6.89	4.06	6.88	4.09	8
9	7.79	4.50	7.77	4.53	7.75	4.57	7.73	4.60	9
10	8.66	5.00	8.64	5.04	8 62	5.08	8.59	5.11	10
11	9.53	5.50	9 50	5.54	9.48	5.58	9.45	5.62	11
12	10.39	6.00	10.37	6.05	10.34	6.09	10.31	6.14	12
13	11.26	6.50	11.23	6.55	11.20	6.60	11.17	6.65	13
14	12.12	7.00	12.09	7.05	12.06	7.11	12.03	7.16	14
15	12.99	7.50	12.96	7.56	12.92	7.61	12.89	7.67	15
16	13.86	8.00	13.82	8.06	13.79	8.12	13.75	8.18	16
17	14.72	8.50	14.69	8.56	14.65	8.63	14.61	8.69	17
18	15.59	9.00	15.55	9.07	15 51	9.14	15.47	9.20	18
19	16.45	9.50	16.41	9.57	16.37	9.64	16.33	9.71	19
20	17.32	10.00	17 28	10.08	17.23	10.15	17.19	10.23	20
21	18.19	10.50	18.14	10.58	18.09	10 66	18.05	10.74	21
22	19.05	11.00	19.00	11.08	18.96	11.17	18.91	11.25	22
23	19.92	11.50	19.87	11.59	19.82	11.67	19.77	11.76	23
24	20.78	12.00	20.73	12.09	20.68	12.18	20.63	12.27	24
25	21.65	12 50	21.60	12.59	21.54	12.69	21.49	12.78	25
26	22.52	13.00	22.46	13.10	22.40	13.20	22.34	13.29	26
27	23.38	13.50	23.32	13.60	23.26	13.70	23.20	13.80	27
28	24.25	14.00	24.19	14.11	24.13	14.21	24.06	14.32	28
29	25.11	14.50	25.05	14.61	24.99	14.72	24.92	14.83	29
30	25.98	15.00	25 92	15.11	25.85	15.23	25.78	15.34	30
31	26.85	15.50	26.78	15.62	26.71	15.73	26.64	15.85	31
32	27.71	16.00	27.64	16.12	27.57	16.24	27.50	16.36	32
33	28.58	16.50	28.51	16.62	28.43	16.75	28.36	16.87	33
34	29.45	17.00	29.37	17.13	29.30	17.26	29.22	17.38	34
35	30.31	17.50	30.23	17.63	30.16	17.76	30.08	17.90	35
36	31.18	18.00	31.10	18.14	31.02	18.27	30.94	18.41	36
37	32.04	18.50	31.96	18.64	31.88	18.78	31.80	18.92	37
38	32.91	19.00	32.83	19.14	32.74	19.29	32.66	19.43	38
39	33.78	19.50	33.69	19.65	33.60	19.79	33.52	19.94	39
40	34.64	20.00	34.55	20.15	34.47	20.30	34.38	20.45	40
41	35.51	20.50	35.42	20.65	35.33	20.81	35.24	20.96	41
42	36.37	21.00	36.28	21.16	36.19	21.32	36.10	21.47	42
43	37.24	21.50	37.15	21.66	37.05	21.82	36.95	21.99	43
44	38.11	22.00	38.01	22.17	37.91	22.33	37.81	22.50	44
45	38.97	22.50	38.87	22.67	38.77	22.84	38.67	23.01	45
46	39.84	23.00	39.74	23.17	39.64	23.35	39.53	23.52	46
47	40.70	23.50	40.60	23.68	40.50	23.85	40.39	24.03	47
48	41.57	24.00	41.46	24.18	41.36	24.36	41.25	24.54	48
49	42.44	24.50	42.33	24.68	42.22	24.87	42.11	25.05	49
50	43.30	25.00	43.19	25.19	43.08	25.38	42.97	25.56	50
Loa.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Loa.
	60 deg.	0 min.	59 deg.	45 min.	59 deg.	30 min.	59 deg.	15 min.	

Loa.	31 deg. 0 min.		31 deg. 15 min.		31 deg. 30 min.		31 deg. 45 min.		Loa.
	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	
1	0.86	0.52	0.85	0.52	0.85	0.52	0.85	0.53	1
2	1.71	1.03	1.71	1.04	1.71	1.04	1.70	1.05	2
3	2.57	1.55	2.56	1.56	2.56	1.57	2.55	1.58	3
4	3.43	2.06	3.42	2.08	3.41	2.03	3.40	2.10	4
5	4.29	2.58	4.27	2.59	4.26	2.61	4.25	2.63	5
6	5.14	3.09	5.13	3.11	5.12	3.13	5.10	3.16	6
7	6.00	3.61	5.98	3.63	5.97	3.60	5.95	3.68	7
8	6.86	4.12	6.84	4.15	6.82	4.18	6.80	4.21	8
9	7.71	4.64	7.69	4.67	7.67	4.70	7.65	4.74	9
10	8.57	5.15	8.55	5.19	8.53	5.22	8.50	5.26	10
11	9.43	5.67	9.40	5.71	9.38	5.75	9.35	5.79	11
12	10.29	6.18	10.26	6.23	10.23	6.27	10.20	6.31	12
13	11.14	6.70	11.11	6.74	11.08	6.79	11.05	6.84	13
14	12.00	7.21	11.97	7.26	11.94	7.32	11.90	7.37	14
15	12.86	7.73	12.82	7.78	12.79	7.84	12.76	7.89	15
16	13.71	8.24	13.68	8.30	13.64	8.36	13.61	8.42	16
17	14.57	8.76	14.53	8.82	14.49	8.88	14.46	8.95	17
18	15.43	9.27	15.39	9.34	15.35	9.40	15.31	9.47	18
19	16.29	9.79	16.24	9.86	16.20	9.93	16.16	10.00	19
20	17.14	10.30	17.10	10.38	17.05	10.45	17.01	10 52	20
21	18.00	10.82	17 95	10.89	17.91	10.97	17.86	11.05	21
22	18.86	11.33	18.81	11.41	18.76	11.50	18.71	11.58	22
23	19.71	11.85	19.66	11.93	19.61	12.02	19.56	12.10	23
24	20.57	12.36	20.52	12.45	20.46	12.54	20.41	12.63	24
25	21.43	12.88	21.37	12.97	21.32	13.06	21.26	13.16	25
26	22.29	13.39	22.23	13.49	22.17	13.59	22.11	13.68	26
27	23.14	13.91	23.08	14.01	23.02	14.11	22.96	14.21	27
28	24.00	14.42	23.94	14.53	23.87	14.63	23.81	14.73	28
29	24.86	14.94	24.79	15.04	24.73	15.16	24.66	15.26	29
30	25.72	15.45	25.65	15.56	25.58	15.68	25.51	15.79	30
31	26.57	15.97	26.50	16.08	26.43	16.20	26.36	16.31	31
32	27.43	16.48	27.36	16.60	27.28	16.72	27.21	16.84	32
33	28.29	17.00	28.21	17.12	28.14	17.24	28.06	17.36	33
34	29.14	17.51	29.07	17.64	28.99	17.77	28.91	17.89	34
35	30.00	18.03	29.92	18.16	29.84	18.29	29.76	18.42	35
36	30.86	18.54	30.78	18.68	30.70	18.81	30.61	18.94	36
37	31.72	19.06	31.63	19.19	31.55	19.33	31.46	19.47	37
38	32.57	19.57	32.49	19.71	32.40	19.86	32.31	20.00	38
39	33.43	20.09	33.34	20.23	33.25	20,38	33.16	20,52	39
40	34.29	20.60	34.20	20.75	34.11	20.90	34.01	21.05	40
41	35.14	21.12	35.05	21.27	34.96	21.42	34.86	21.57	41
42	36.00	21.63	35.91	21.79	35.81	21.95	35.71	22.10	42
43	36.86	22.15	36.76	22.31	36.66	22.47	36.57	22.63	43
44	37.72	22.66	37.62	22.83	37.52	22.99	37.42	23.15	44
45	38.57	23.18	38.47	23.34	38.37	23.51	38.27	23.68	45
46	39.43	23.69	39.33	23.86	39.22	24.04	39.12	24.21	46
47	40.29	24.21	40.18	24.38	40.07	24.56	39.97	24.73	47
48	41.14	24.72	41.04	24.90	40.93	25.08	40.82	25.26	48
49	42.00	25.24	41.89	25.42	41.78	25.60	41.67	25.78	49
50	42.86	25.75	42.75	25.94	42.63	26.12	42.52	26.31	50
Loa.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Loa.
	59 deg.	0 min.	58 deg.	45 min.	58 deg.	30 min.	58 deg.	15 min.	

Loa.	32 deg. 0 min.		32 deg. 15 min.		32 deg. 30 min.		32 deg. 45 min.		Loa.
	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	
1	0.85	0.53	0.85	0.53	0.84	0.54	0.84	0.54	1
2	1.70	1.06	1.69	1.07	1.69	1.07	1.68	1.08	2
3	2.54	1.59	2.54	1.60	2.53	1.61	2.52	1.62	3
4	3.39	2.12	3.38	2.13	3.37	2.15	3.36	2.16	4
5	4 24	2.65	4.23	2.67	4.22	2.69	4.21	2.70	5
6	5.09	3.18	5.07	3.20	5.06	3.22	5.05	3.25	6
7	5.94	3.71	5 92	3.74	5.90	3.76	5.89	3.79	7
8	6.78	4.24	6.77	4.27	6.75	4 30	6.73	4.33	8
9	7.63	4.77	7.61	4.80	7.59	4.84	7.57	4.87	9
10	8. 48	5.30	8.46	5.34	8.43	5.37	8.41	5.41	10
11	9.33	5.83	9.30	5.87	9.28	5.91	9.25	5.95	11
12	10.18	6.36	10 15	6.40	10.12	6.45	10.09	6.49	12
13	11.02	6.89	10.99	6.94	10.96	6.98	10.93	7.03	13
14	11.87	7.42	11.84	7.47	11.81	7.52	11.77	7.57	14
15	12.72	7.95	12.69	8.00	12.65	8.06	12.62	8.11	15
16	13.57	8.48	13.53	8.54	13.49	8.60	13.46	8.66	16
17	14.42	9 01	14.38	9.07	14.34	9.13	14.30	9.20	17
18	15.26	9.54	15.22	9.60	15.18	9.67	15.14	9.74	18
19	16.11	10.07	16.07	10.14	16.02	10.21	15.98	10.28	19
20	16 96	10.60	16.91	10.67	16.87	10.75	16.82	10.82	20
21	17.81	11.13	17.76	11.21	17.71	11.28	17.66	11.36	21
22	18.66	11.66	18.61	11.74	18.55	11.82	18.50	11.90	22
23	19.51	12.19	19.45	12.27	19.40	12.36	19.34	12.44	23
24	20.35	12.72	20.30	12.81	20.24	12.90	20.18	12.98	24
25	21.20	13.25	21.14	13.34	21.08	13.43	21.03	13.52	25
26	22.05	13.78	21.99	13.87	21.93	13.97	21.87	14.07	26
27	22.90	14.31	22.83	14.41	22.77	14.51	22.71	14.61	27
28	23.75	14.84	23.68	14.94	23.61	15.04	23.55	15.15	28
29	24.59	15.37	24.53	15.47	24.40	15.58	24.39	15.69	29
30	25.44	15.90	25.37	16.01	25.30	16.12	25.23	16.23	30
31	26.29	16.43	26.22	16.54	26.15	16.66	26.07	16.77	31
32	27.14	16.96	27.06	17.08	26.99	17.19	26.91	17.31	32
33	27.99	17.49	27.91	17.61	27.83	17.73	27.75	17.85	33
34	28.83	18 02	28.75	18.14	28.68	18.27	28.60	18.39	34
35	29.68	18.55	29.60	18.68	29.52	18.81	29.44	18.93	35
36	30.53	19.08	30.45	19.21	30.36	19.34	30.28	19.47	36
37	31.38	19.61	31.29	19.74	31.21	19.88	31.12	20.02	37
38	32 23	20.14	32.14	20.28	32.05	20.42	31.96	20.56	38
39	33.07	20.67	32.98	20.81	32.89	20.95	32.80	21.10	39
40	33.92	21.20	33.83	21.34	33.74	21.49	33.64	21.64	40
41	34.77	21.73	34.67	21.88	34.58	22.03	34.48	22.18	41
42	35.62	22.26	35.52	22.41	35.42	22.57	35.32	22.72	42
43	36.47	22.79	36.37	22.95	36.27	23.10	36.16	23.26	43
44	37.31	23.32	37.21	23.48	37.11	23.64	37.01	23.80	44
45	38.16	23.85	38.06	24.01	37 95	24.18	37.85	24.34	45
46	39.01	24.38	38.90	24.55	38.80	24.72	38.69	24.88	46
47	39.86	24.91	39.75	25.08	39.64	25.25	39.53	25.43	47
48	40.71	25.44	40.60	25.61	40.48	25.79	40.37	25.97	48
49	41.55	25.97	41.44	26.15	41.33	26.33	41.21	26.51	49
50	42 40	26.50	42.29	26.68	42.17	26 86	42.05	27.05	50
Loa.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Loa.
	58 deg.	0 min.	57 deg.	45 min.	57 deg.	30 min.	57 deg.	15 min.	

Lon.	33 deg. 0 min.		33 deg. 15 min.		33 deg. 30 min.		33 deg. 45 min.		Lon.
	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	
1	0.84	0.54	0.84	0.55	0.83	0.55	0.83	0.56	1
2	1.68	1.09	1.67	1.10	1.67	1.10	1.66	1.11	2
3	2.52	1.63	2.51	1.64	2.50	1.66	2.49	1.67	3
4	3.35	2.18	3.35	2.19	3.34	2.21	3.33	2.22	4
5	4.19	2.72	4.18	2.74	4.17	2.76	4.16	2.78	5
6	5.03	3.27	5.02	3.29	5.00	3.31	4.99	3.33	6
7	5.87	3.81	5.85	3.84	5.84	3.86	5.82	3.89	7
8	6.71	4.36	6.69	4.39	6.67	4.42	6.65	4.44	8
9	7.55	4.90	7.53	4.93	7.51	4.97	7.48	5.00	9
10	8.39	5.45	8.36	5.48	8.34	5.52	8.31	5.56	10
11	9.23	5.99	9.20	6.03	9.17	6.07	9.15	6.11	11
12	10.06	6.54	10.04	6.58	10.01	6.62	9.98	6.67	12
13	10.90	7.08	10.87	7.13	10.84	7.18	10.81	7.22	13
14	11.74	7.62	11.71	7.68	11.67	7.73	11.64	7.78	14
15	12.58	8.17	12.54	8.22	12.51	8.28	12.47	8.33	15
16	13.42	8.71	13.38	8.77	13.34	8.83	13.30	8.89	16
17	14.26	9.26	14.22	9.32	14.18	9.38	14.13	9.44	17
18	15.10	9.80	15.05	9.87	15.01	9.93	14.97	10.00	18
19	15.93	10.35	15.89	10.42	15.84	10.49	15.80	10.56	19
20	16.77	10.89	16.73	10.97	16.68	11.04	16.63	11.11	20
21	17.61	11.44	17.56	11.51	17.51	11.59	17.46	11.67	21
22	18.45	11.98	18.40	12.06	18.35	12.14	18.29	12.22	22
23	19.29	12.53	19.23	12.61	19.18	12.69	19.12	12.78	23
24	20.13	13.07	20.07	13.16	20.01	13.25	19.96	13.33	24
25	20.97	13.62	20.91	13.71	20.85	13.80	20.79	13.89	25
26	21.81	14.16	21.74	14.26	21.68	14.35	21.62	14.44	26
27	22.64	14.71	22.58	14.80	22.52	14.90	22.45	15.00	27
28	23.48	15.25	23.42	15.35	23.35	15.45	23.28	15.56	28
29	24.32	15.79	24.25	15.90	24.18	16.01	24.11	16.11	29
30	25.16	16.34	25.09	16.45	25.02	16.56	24.94	16.67	30
31	26.00	16.88	25.92	17.00	25.85	17.11	25.78	17.22	31
32	26.84	17.43	26.76	17.55	26.68	17.66	26.61	17.78	32
33	27.68	17.97	27.60	18.09	27.52	18.21	27.44	18.33	33
34	28.51	18.52	28.43	18.64	28.35	18.77	28.27	18.89	34
35	29.35	19.06	29.27	19.19	29.19	19.32	29.10	19.44	35
36	30.19	19.61	30.11	19.74	30.02	19.87	29.93	20.00	36
37	31.03	20.15	30.94	20.29	30.85	20.42	30.76	20.56	37
38	31.87	20.70	31.78	20.84	31.69	20.97	31.60	21.11	38
39	32.71	21.24	32.62	21.38	32.52	21.53	32.43	21.67	39
40	33.55	21.79	33.45	21.93	33.36	22.08	33.26	22.22	49
41	34.89	22.33	34.29	22.48	34.19	22.63	34.09	22.78	41
42	35.22	22.87	35.12	23.03	35.02	23.18	34.92	23.33	42
43	36.06	23.42	35.96	23.58	35.86	23.73	35.75	23.89	43
44	36.90	23.96	36.80	24.12	36.69	24.29	36.58	24.45	44
45	37.74	24.51	37.63	24.67	37.53	24.84	37.42	25.00	45
46	38.58	25.05	38.47	25.22	38.36	25.39	38.25	25.56	46
47	39.42	25.60	39.31	25.77	39.19	25.94	39.08	26.11	47
48	40.26	26.14	40.14	26.32	40.03	26.49	39.91	26.67	48
49	41.09	26.69	40.98	26.87	40.86	27.05	40.74	27.22	49
50	41.93	27.23	41.81	27.41	41.69	27.60	41.57	27.78	50
Lon.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.
	57 deg. 0 min.		56 deg. 45 min.		56 deg. 30 min.		56 deg. 15 min.		

Loa.	34 deg. 0 min.		34 deg. 15 min.		34 deg. 30 min.		34 deg. 45 min		Loa.
	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	
1	0.83	0.56	0.83	0.56	0.82	0.57	0.82	0.57	1
2	1.66	1.12	1.65	1.13	1.65	1.13	1.64	1.14	2
3	2.49	1.68	2.48	1.69	2.47	1.70	2.46	1.71	3
4	3.32	2.24	3.31	2.25	3.30	2.27	3.29	2.28	4
5	4.15	2.80	4.13	2.81	4.12	2.83	4.11	2.85	5
6	4.97	3.36	4.96	3.38	4.94	3.40	4.93	3.42	6
7	5.80	3.91	5.79	3.94	5.77	3.96	5.75	3.99	7
8	6.63	4.47	6.61	4.50	6.59	4.53	6.57	4.56	8
9	7.46	5.03	7.44	5.07	7.42	5.10	7.39	5.13	9
10	8.29	5.59	8.27	5.63	8.24	5.66	8.22	5.70	10
11	9.12	6.15	9.09	6.19	9.07	6.23	9.04	6.27	11
12	9.95	6.71	9.92	6.75	9.89	6.80	9.86	6 84	12
13	10.78	7.27	10.75	7.32	10.71	7.36	10.68	7.41	13
14	11.61	7.83	11.57	7.88	11.54	7.93	11.50	7.98	14
15	12.44	8.39	12.40	8.44	12.36	8.50	12.32	8.55	15
16	13.26	8.95	13.23	9.00	13.19	9.06	13.15	9.12	16
17	14.09	9.51	14.05	9.57	14.01	9.63	13.97	9.69	17
18	14.92	10.07	14.88	10.13	14.83	10.20	14.79	10.26	18
19	15.75	10 62	15.71	10 69	15.66	10.76	15.61	10.83	19
20	16.58	11.18	16.53	11.26	16.48	11.33	16.43	11.40	20
21	17.41	11.74	17.36	11.82	17.31	11.89	17.25	11.97	21
22	18.24	12.30	18.18	12.38	18.13	12.46	18.08	12.54	22
23	19.07	12.86	19.01	12.94	18.95	13.03	18.90	13.11	23
24	19.90	13.42	19.84	13.51	19.78	13.59	19.72	13.68	24
25	20.73	13.98	20.66	14.07	20.60	14.16	20.54	14.25	25
26	21.56	14.54	21.49	14.63	21.43	14.73	21.36	14.82	26
27	22.38	15.10	22.32	15.20	22.25	15.29	22.18	15.39	27
28	23.21	15.66	23.14	15.76	23.08	15.86	23.01	15.96	28
29	24.04	16.22	23.97	16.32	23.90	16.43	23.83	16.53	29
30	24.87	16.78	24.80	16.88	24.72	16.99	24.65	17.10	30
31	25.70	17.33	25.62	17.45	25.55	17.56	25.47	17.67	31
32	26.53	17.89	26.45	18.01	26.37	18.13	26.29	18.24	32
33	27.36	18.45	27.28	18.57	27.20	18.69	27.11	18.81	33
34	28.19	19.01	28.10	19.14	28.02	19.26	27.94	19.38	34
35	29.02	19.57	28.93	19.70	28.84	19.82	28.76	19.95	35
36	29.85	20.13	29.76	20.26	29.67	20.39	29.58	20.52	36
37	30.67	20 69	30.58	20.82	30.49	20.96	30.40	21.09	37
38	31.50	21.25	31.41	21.39	31.32	21.52	31.22	21.66	38
39	32.33	21.81	32.24	21.95	32.14	22.09	32.04	22.23	39
40	33.16	22.37	33.06	22.51	32.97	22.66	32.87	22.80	40
41	33.99	22.93	33.89	23.07	33.79	23.22	33.69	23.37	41
42	34.82	23.49	34.72	23.64	34.61	23.79	34.51	23 94	42
43	35.65	24.05	35.54	24.20	35.44	24.36	35.33	24.51	43
44	36.48	24.60	36.37	24.76	36.26	24.92	36.15	25.08	44
45	37.31	25.16	37.20	25.33	37.09	25.49	36.97	25.65	45
46	38.14	25.72	38.02	25.89	37.91	26.05	37.80	26.22	46
47	38.96	26.28	38.85	26.45	38.73	26.62	38.62	26.79	47
48	39.79	26.84	39.68	27.01	39.56	27.19	39.44	27.36	48
49	40.62	27.40	40.50	27.58	40.38	27.75	40.26	27.93	49
50	41.45	27.96	41.33	28.14	41.21	28.32	41.08	28.50	50
Loa.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Loa.
	56 deg. 0 min.		55 deg. 45 min.		55 deg. 30 min.		55 deg. 15 min.		

Loa.	35 deg. 0 min.		35 deg. 15 min.		35 deg. 30 min.		35 deg. 45 min.		Loa.
	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	
1	0.82	0.57	0.82	0.58	0.81	0.58	0.81	0.58	1
2	1.64	1.15	1.63	1.15	1.63	1.16	1.62	1.17	2
3	2.46	1.72	2.45	1.73	2.44	1.74	2.43	1.75	3
4	3.28	2.29	3.27	2.31	3.26	2.32	3.25	2.34	4
5	4.10	2.87	4.08	2.89	4.07	2.90	4.06	2.92	5
6	4.91	3.44	4.90	3.46	4.88	3.48	4.87	3.51	6
7	5.73	4.02	5.72	4.04	5.70	4.06	5.68	4.09	7
8	6.55	4.59	6.53	4.62	6.51	4.65	6.49	4.67	8
9	7.37	5.16	7.35	5.19	7.33	5.23	7.30	5.26	9
10	8.19	5.74	8.17	5.77	8.14	5.81	8.12	5.84	10
11	9.01	6.31	8.98	6.35	8 96	6.39	8.93	6.43	11
12	9.83	6.88	9 80	6.93	9.77	6.97	9.74	7.01	12
13	10.65	7.46	10.62	7.50	10.58	7.55	10.55	7.60	13
14	11.47	8.03	11.43	8.08	11.40	8.13	11.36	8.18	14
15	12.29	8.60	12.25	8.66	12.21	8.71	12.17	8.76	15
16	13.11	9.18	13.07	9.23	13.03	9.29	12.99	9.35	16
17	13.93	9.75	13 88	9.81	13.84	9.87	13.80	9.93	17
18	14.74	10.32	14 70	10.39	14.65	10 45	14.61	10 52	18
19	15.56	10.90	15.52	10.97	15.47	11.03	15.42	11.10	19
20	16.38	11.47	16.33	11.54	16.28	11.61	16.23	11.68	20
21	17.20	12.05	17.15	12.12	17.10	12.19	17.04	12.27	21
22	18.02	12.62	17.97	12.70	17.91	12.78	17.85	12.85	22
23	18.84	13.19	18.78	13.27	18.72	13.36	18.67	13.44	23
24	19.66	13.77	19.60	13.85	19.54	13.94	19.48	14.02	24
25	20.48	14.34	20.42	14.43	20.35	14.52	20.29	14.61	25
26	21.30	14.91	21.23	15.01	21.17	15.10	21.10	15.19	26
27	22.12	15.49	22.05	15.58	21.98	15.68	21.91	15.77	27
28	22.94	16.06	22.87	16.16	22.80	16.26	22.72	16.36	28
29	23.76	16.63	23.68	16.74	23.61	16.84	23.54	16.94	29
30	24.57	17.21	24.50	17.31	24.42	17.42	24.35	17.53	30
31	25.39	17.78	25.32	17.89	25.24	18.00	25.16	18.11	31
32	26.21	18.35	26.13	18.47	26.05	18.58	25.97	18.70	32
33	27.03	18.93	26.95	19.05	26.87	19.16	26.78	19.28	33
34	27.85	19.50	27.77	19.62	27.68	19.74	27.59	19.86	34
35	28 67	20 08	28.58	20.20	28.49	20.32	28.40	20.45	35
36	29.49	20.65	29.40	20.78	29.31	20.91	29.22	21.03	36
37	30.31	21.22	30.22	21.35	30.12	21.49	30.03	21.62	37
38	31.13	21.80	31.03	21.93	30.94	22.07	30.84	22.20	38
39	31.95	22.37	31.85	22.51	31.75	22.65	31.65	22.79	39
40	32.77	22.94	32.67	23.09	32.56	23.23	32.46	23.37	40
41	33.59	23.52	33.48	23.66	33.38	23.81	33.27	23.95	41
42	34.40	24.09	34.30	24.24	34.19	24.39	34.09	24.54	42
43	35.22	24.66	35.12	24.82	35.01	24.97	34.90	25.12	43
44	36.04	25.24	35.93	25.39	35.82	25.55	35.71	25.71	44
45	36.86	25.81	36.75	25.97	36.64	26.13	36.52	26.29	45
46	37.68	26.38	37.57	26.55	37.45	26.71	37.33	26.88	46
47	38.50	26.96	38.38	27.13	38.26	27.29	38.14	27.46	47
48	39.32	27.53	39.20	27.70	39.08	27.87	38.96	28.04	48
49	40.14	28.11	40.02	28.28	39.89	28.45	39.77	28.63	49
50	40.96	28.68	40.83	28.86	40.71	29.04	10.58	29.21	50
Loa.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Loa.
	55 deg. 0 min.		54 deg. 45 min.		54 deg. 30 min.		54 deg. 15 min.		

Loa.	36 deg. 0 min.		36 deg. 15 min.		36 deg. 30 min.		36 deg. 45 min.		Loa.
	Lat	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	
1	0.31	0.59	0.31	0.59	0.30	0.59	0.30	0.60	1
2	1.62	1.18	1.61	1.18	1.61	1.19	1.60	1.20	2
3	2.43	1.76	2.42	1.77	2.41	1.78	2.40	1.79	3
4	3.24	2.35	3.23	2.37	3.22	2 38	3.20	2.39	4
5	4 05	2.94	4.03	2.96	4.02	2.97	4.01	2.99	5
6	4.85	3.53	4.84	3.55	4.82	3.57	4.81	3.59	6
7	5.66	4.11	5.65	4.14	5.63	4.16	5.61	4.19	7
8	6.47	4.70	6.45	4.73	6.43	4.76	6.41	4.79	8
9	7.28	5.29	7.26	5.32	7.23	5.35	7.21	5.38	9
10	8.09	5.88	8.06	5.91	8.04	5.95	8.01	5.98	10
11	8.90	6.47	8.87	6.50	8.84	6.54	8.81	6.58	11
12	9.71	7.05	9.68	7.10	9.65	7.14	9.61	7.18	12
13	10.52	7.64	10.48	7.69	10.45	7.73	10.42	7.78	13
14	11.33	8.23	11.29	8.28	11.25	8.33	11.22	8.38	14
15	12.14	8.82	12.10	8.87	12.06	8.92	12.02	8.97	15
16	12.94	9.40	12.90	9.46	12.86	9.52	12.82	9.57	16
17	13.75	9.99	13.71	10.05	13.67	10.11	13.62	10.91	17
18	14.56	10.58	14.52	10.64	14.47	10.71	14.42	10.77	18
19	15.37	11.17	15.32	11.23	15.27	11.30	15.22	11.37	19
20	16.18	11.76	16.13	11.83	16.08	11.90	16.02	11.97	20
21	16 99	12.34	16.94	12.42	16.88	12.49	16.83	12.56	21
22	17.80	12.93	17.74	13.01	17.68	13.09	17.63	13 16	22
23	18.61	13.52	18.55	13.60	18.49	13.68	18.43	13.76	23
24	19.42	14.11	19.35	14.19	19.29	14.28	19.23	14.36	24
25	20.23	14.69	20.16	14.78	20.10	14.87	20.03	14.96	25
26	21.03	15.28	20.97	25.37	20.90	15.47	20.83	15.56	26
27	21.84	15.87	21.77	15.97	21.70	16.06	21.63	16.15	27
28	22.65	16.46	22.58	16.56	22.51	16.65	22.43	16.75	28
29	23.46	17.05	23.39	17.15	23.31	17.25	23.24	17.35	29
30	24.27	17.63	24.19	17.74	24.12	17.84	24.04	17.95	30
31	25.08	18 22	25.00	18.33	24.92	18.44	24.84	18.55	31
32	25.89	18.81	25.81	18.92	25.72	19 03	25.64	19.15	32
33	26.70	19.40	26.61	19.51	26.53	19.63	26.44	19 74	33
34	27.51	19.98	27.42	20.10	27.33	20.22	27.24	20.34	34
35	28.32	20.57	28.23	20.70	28.14	20.82	28.04	20.94	35
36	29.12	21.16	29.03	21.29	28.94	21.41	28.84	21.54	36
37	29.93	21.75	29.84	21.88	29.74	22.01	29.65	22.14	37
38	30.74	22.34	30.64	22.47	30.55	22.60	30.45	22.74	38
39	31.55	22.92	31.45	23.06	31.35	23.20	31.25	23.33	39
40	32 36	23.51	32.26	23.65	32.15	23.79	32.05	23.93	40
41	33.17	24.10	33.06	24.24	32.96	24.39	32.85	24.53	41
42	33.98	24.69	33.87	24.84	33.76	24.98	33.65	25.13	42
43	34.79	25.27	34.68	25.43	34.57	25.58	34.45	25.73	43
44	35.60	25.86	35.48	26.02	35.37	26.17	35.25	26.33	44
45	36.41	26.45	36.29	26.61	36.17	26.77	36.06	26.92	45
46	37.21	27.04	37.10	27.20	36.98	27.36	36.86	27.52	46
47	38.02	27.63	37.90	27.79	37.78	27.96	37.66	28.12	47
48	38 83	28.21	38.71	28.38	38 59	28.55	38.46	28.72	48
49	39.64	28.80	39.52	28.97	39.39	29.15	39.26	29.32	49
50	40.45	29.39	40.32	29.57	40.19	29.74	40.06	29.92	50
Loa.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Loa.
	54 deg. 0 min.		53 deg. 45 min.		53 deg. min. 53		30 deg. 15 min.		

Loa.	37 deg. 0 min.		37 deg. 15 min.		37 deg. 30 min.		37 deg. 45 min.		Loa.
	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	
1	0.80	0.60	0.80	0.61	0.79	0.61	0.79	0.61	1
2	1.60	1.20	1.59	1.21	1.59	1.22	1.58	1.22	2
3	2.40	1.81	2.39	1.82	2.38	1.83	2.37	1.84	3
4	3.19	2.41	3.18	2.42	3.17	2.44	3.16	2.45	4
5	3.99	3.01	3.98	3.03	3.97	3.04	3.95	3.06	5
6	4.79	3.61	4.78	3.63	4.76	3.65	4.74	3.67	6
7	5.59	4.21	5.57	4.24	5.55	4.26	5.53	4.29	7
8	6.39	4.81	6.37	4.84	6.35	4.87	6.33	4.90	8
9	7.19	5.42	7.16	5.45	7.14	5.48	7.12	5.51	9
10	7.99	6.02	7.96	6.05	7.93	6.09	7.91	6.12	10
11	8.79	6.62	8.76	6.66	8.73	6.70	8.70	6.73	11
12	9.58	7.22	9.55	7.26	9.52	7.31	9.49	7.35	12
13	10.38	7.82	10.35	7.87	10.31	7.91	10.28	7.96	13
14	11.18	8.43	11.14	8.47	11.11	8.52	11.07	8.57	14
15	11.98	9.03	11.94	9.08	11.90	9.13	11.86	9.18	15
16	12.78	9.63	12.74	9.68	12.69	9.74	12.65	9.80	16
17	13.58	10.23	13.53	10.29	13.49	10.35	13.44	10.41	17
18	14.38	10.83	14.33	10.90	14.28	10.96	14.23	11.02	18
19	15.17	11.43	15.12	11.50	15.07	11.57	15.02	11 63	19
20	15.97	12.04	15.92	12.11	15.87	12.18	15.81	12.24	20
21	16.77	12.64	16.72	12.71	16.66	12.78	16.60	12.86	21
22	17.57	13.24	17.51	13.32	17.45	13.39	17.40	13.47	22
23	18.37	13.84	18.31	13.92	18.25	14.00	18.19	14.08	23
24	19.17	14.44	19.10	14.53	19.04	14.61	18.98	14.69	24
25	19.97	15.05	19.90	15.13	19.83	15.22	19.77	15.31	25
26	20.76	15.65	20.70	15.74	20.63	15.83	20.56	15.92	26
27	21.56	16.25	21.49	16.34	21.42	16.44	21.35	16.53	27
28	22.36	16.85	22.29	16.95	22.21	16.65	22 14	17.14	28
29	23.16	17.45	23.08	17.55	23.01	17.65	22.93	17.75	29
30	23.96	18.05	23.88	18.16	23.80	18.26	23.72	18.37	30
31	24.76	18.66	24.68	18.76	24.59	18.87	24.51	18.98	31
32	25.56	19.26	25.47	19.37	25.39	19.48	25.30	19.59	32
33	26.36	19.86	26.27	19.97	26.18	20.09	26.09	20.20	33
34	27.15	20.46	27.06	20.58	26.97	20.70	26.88	20.82	34
35	27.95	21.06	27.86	21.19	27.77	21.31	27.67	21.43	35
36	28.75	21.67	28.66	21.79	28.56	21.92	28.46	22.04	36
37	29.55	22.27	29.45	22.40	29.35	22.52	29.26	22.65	37
38	30.35	22.87	30.25	23.00	30.15	23.13	30.05	23.26	38
39	31.15	23.47	31.04	23.61	30.94	23.74	30.84	23.88	39
40	31.95	24.07	31.84	24.21	31.73	24.35	31.63	24.49	40
41	32.74	24.67	32.64	24.82	32.53	24.96	32.42	25.10	41
42	33.54	25.28	33.43	25.42	33.32	25.57	33.21	25.71	42
43	34.34	25.88	34.23	26.03	34.11	26.18	34.00	26.33	43
44	35.14	26.48	35.02	26.63	34.91	26.79	34.79	26.94	44
45	35.94	27.08	35.82	27.24	35.70	27.39	35.58	27.55	45
46	36.74	27.68	36.62	27.84	36.49	28.00	36 37	28.16	46
47	37.54	28.29	37.41	28.45	37.29	28.61	37.16	28.77	47
48	38.33	28.89	38.21	29.05	38.08	29.22	37.95	29.39	48
49	39.13	29.49	39.00	29.66	38.87	29.83	38.74	30.00	49
50	39.93	30.09	39.80	30.26	39.67	30.44	39.53	30.61	50
Loa.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Loa.
	53 deg. 0 min.		52 deg. 45 min.		52 deg. 30 min.		52 deg. 15 min.		

Loa.	33 deg. 0 min.		33 deg. 15 min.		33 deg. 30 min.		33 deg. 45 min.		Loa.
	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	
1	0.79	0.62	0.79	0.62	0.78	0.62	0.78	0.63	1
2	1.58	1.23	5.17	1.24	1.57	1 25	1.56	1.25	2
3	2.36	1.85	2.36	1.86	2.35	1 87	2.34	1.88	3
4	3.15	2 46	3.14	2.48	3.13	2.49	3.12	2.50	4
5	3.94	3.08	3.93	3.10	3.91	3.11	3.90	3.13	5
6	4.73	3.69	4.71	3.71	4.70	3.74	4.68	3.76	6
7	5.52	4.31	5.50	4.33	5.48	4.36	5.46	4.38	7
8	6.30	4.93	6.28	4.95	6.26	4.98	6.24	5.01	8
9	7.09	5.54	8.07	5.57	7.04	5.60	7.02	5.63	9
10	7.88	6.16	1.85	6.19	7.83	6.23	7.80	6.26	10
11	8.67	6.77	8.64	6.81	8.61	6.85	8.58	6.89	11
12	9.46	7.39	9.42	7.43	9.39	7.47	9.36	7.51	12
13	10.24	8.00	10.21	8.05	10.17	8.09	10.14	8.14	13
14	11.03	8.62	10.99	8.67	10.96	8.72	10.92	8.76	14
15	11.82	9.23	11.78	9.29	11.74	9.34	11.70	9.39	15
16	12.61	9.85	12.57	9.91	15.52	9.96	12.48	10.01	16
17	13.40	10.47	13.35	10.52	13.30	10.58	13.26	10.64	17
18	14.18	11.08	14.14	11.14	14.09	11.21	14.04	11.27	18
19	14.97	11.70	14.92	11.76	14.87	11.83	14.82	11.89	19
20	15.76	12.31	15.71	12.38	15.65	12.45	15.60	12.52	20
21	16.55	12.93	16.49	13.00	16.43	13.07	16.38	13.14	21
22	17.34	13.54	17.28	13.62	17.22	13.70	17.16	13.77	22
23	18.12	14.16	18.06	14 24	18.00	14.32	17.94	14.40	23
24	18.91	14.78	18.85	14.86	18.78	14.94	18.72	15.02	24
25	19.70	15.39	19.63	15.48	19.57	15.56	19.50	15.65	25
26	20.49	16.01	20.42	16.10	20.35	16.19	20.28	16.27	26
27	21.28	16.62	21.20	16.72	21.13	16.81	21.06	16.90	27
28	22.06	17.24	21.99	17.33	21.91	17.43	21.84	17.53	28
29	22 85	17.85	22.77	17.95	22.70	18.05	22.62	18.15	29
30	23.64	18.47	23.56	18.57	23.48	18.68	23 40	18.78	30
31	24.43	19.09	24.34	19.19	24.26	19.30	24.18	19.40	31
32	25.22	19.70	25.13	19.81	25.04	19.92	24.96	20.03	32
33	26.00	20.32	25.92	20.43	25.83	20.45	25.74	20.66	33
34	26.79	20.93	26.70	21.05	26.61	21.17	26.52	21.28	34
35	27.58	21.55	27.49	21.67	27.39	21.79	27.30	21.91	35
36	28.37	22.16	28.27	22.29	28.17	22.41	28.08	22.53	36
37	29.16	22.78	29.06	22.91	28.96	23.03	28.86	23.16	37
38	29.94	23.40	29.84	23.53	29.74	23.66	29.64	23.78	38
39	30.73	24.01	30.63	24.14	30.52	24.28	30.42	24.41	39
40	31.52	24.63	31.41	24.76	31.30	24.90	31.20	25 04	40
41	32.31	25.24	32.20	25.38	32.09	25.52	31.98	25.66	41
42	33.10	25.86	32.98	26.00	32.87	26.15	32.75	26.29	42
43	33.88	26.47	33.77	26.62	33.65	26.77	33.53	26.91	43
44	34.67	27.09	34.55	27.24	34.43	27.39	34.31	27.54	44
45	35.46	27.70	35.34	27.86	35.22	28.01	35.09	28.17	45
46	36.25	28.32	36.12	28.48	36.00	28.64	35.87	28.79	46
47	37.40	28.94	36.91	29.10	36.78	29.26	36.65	29.42	47
48	37.82	29.55	37.70	29.72	37.57	29.88	47.43	30.04	48
49	38.61	30.17	38.48	30.34	38.35	30.50	38.21	30.67	49
50	39.40	30.78	39.27	30.95	39.13	31.13	38.99	31.30	50
Lon.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Loa.
	52 deg. 0 min.		51 deg. 45 min.		51 deg. 30 min.		51 deg. 15 min.		

Log.	39 deg. 0 min.		39 deg. 15 min.		39 deg. 30 min		39 deg. 45 min		Log.
	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	
1	0.78	0.66	0.77	0.63	0.77	0.64	0.77	0.64	1
2	1.55	1.26	1.55	1.27	1.54	1.27	1.54	1.28	2
3	2.33	1.89	2.32	1.90	2.31	1.91	2.31	1.92	3
4	3.11	2.52	3.10	2.53	3.09	2.54	3.08	2.56	4
5	3.89	3.15	3.87	3.16	3 86	3.18	3.84	3.20	5
6	4.66	3.78	4.65	3.80	4.63	3 82	4.61	3.84	6
7	5.44	4.41	5.42	4.43	5.40	4.45	5.38	4.48	7
8	6.22	5.03	6.20	5.06	6.17	5.09	6.15	5.12	8
9	6.99	5 66	6.97	5.69	6.94	5.72	6.92	5.76	9
10	7.77	6.29	7.74	6.33	7.72	6.36	7.69	6 39	10
11	8.55	6.92	8.52	6.96	8.49	7.00	8.46	7.03	11
12	9.33	7.55	9.29	7.59	9.26	7.63	9.23	7.67	12
13	10.10	8.18	10.07	8.23	10.03	8.27	9.99	8.31	13
14	10.88	8.81	10.84	8.86	10.80	8.91	10.76	8.95	14
15	11.66	9.44	11.62	9.49	11.57	9.54	11.53	9 59	15
16	12.43	10.07	12.39	10.12	12.35	10.18	12.30	10.23	16
17	13.21	10.70	13.16	10.76	13.12	10.81	13.07	10.87	17
18	13.99	11.33	13.94	11.39	13.89	11.45	13.84	11.51	18
19	14.77	11.96	14.71	12.02	14.66	12.09	14.61	12.15	19
20	15.54	12.59	15.49	12.65	15.43	12.72	15 38	12.79	20
21	16.32	13.22	16.26	13.29	16 20	13.36	16.15	13.43	21
22	17.10	13.84	17.04	13.92	16.98	13.99	16.91	14.07	22
23	17.87	14.47	17.81	14 55	17.75	14.63	17 68	14.71	23
24	18 65	15.10	18.59	15.19	18.52	15.27	18.45	15.35	24
25	19.43	15.73	19.36	15.82	19.29	15.90	19.22	15.99	25
26	20.21	16.36	20 13	16 45	20.06	16.54	19.99	16.63	26
27	20.98	16.99	20.91	17.08	20.83	17.17	20.76	17.26	27
28	21.76	17.62	21.68	17 72	21 61	17.81	21.53	17.90	28
29	22.54	18.25	22.46	18.35	22.38	18.45	22.30	18.54	29
30	23.31	18 88	23.23	18.98	23.15	19.08	23.07	19.18	30
31	24.09	19.51	24.01	19.61	23.92	19.72	23.83	19.28	31
32	24.87	20.14	24.78	20.25	24.69	20.35	24.60	20.46	32
33	25.65	20.77	25.55	20.88	25.46	20.99	25.37	21.10	33
34	26.42	21.40	26.33	21.51	26.24	21.63	26.14	21.74	34
35	27.20	22.03	27.10	22.14	27.01	22.26	26.91	12.33	35
36	27.98	22.66	27.88	22.78	27.78	22.90	27.68	23.02	36
37	28.75	23.28	28.65	23.41	28.55	23.53	28.45	23.66	37
38	29.53	23.91	29.43	24.04	29.32	24.17	29.22	24.30	38
39	30.31	24.54	30.20	24.68	30.09	24.81	29.98	24.44	39
40	31.09	25.17	30.98	25.31	30.86	25.44	30.75	25.58	40
41	31.86	25.80	31.75	25.94	31.64	26.08	31.52	26.22	41
42	32.64	26.43	32.52	26.57	32.41	26.72	32.29	26.86	42
43	33.42	27.06	33.30	27.21	33.18	27.35	33.06	27.50	43
44	34.19	27.69	34.07	27.84	33.95	27.99	33.83	28.14	44
45	34.97	28.32	34.85	28.47	34.72	28.62	34.60	28.77	45
46	35.75	28.95	35.62	29.10	35.49	29.26	35.37	29.41	46
47	36.53	29.58	36.40	29.74	36.27	29.90	36.14	30.05	47
48	37.30	30.21	37.17	30.37	37.04	30.53	36.90	30.69	48
49	38.08	30.84	37.95	31.00	37.81	31.17	37.67	31.33	49
50	38.86	31.47	38.72	31.64	38.58	31.80	38.44	31.97	50
Log.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Log.
	51 deg. 0 min.		50 deg. 45 min.		50 deg. 30 min.		50 deg. 15 min.		

Loa.	40 deg. 0 min.		40 deg. 15 min.		40 deg. 30 min.		40 deg. 45 min.		Loa.
	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	
1	0.77	0.61	0.76	0.65	0.76	0.65	0.76	0.65	1
2	1.53	1.29	1.53	1.29	1.52	1.30	1.52	1.31	2
3	2.30	1.93	2.29	1.94	2.28	1.95	2.27	1.96	3
4	3.06	2.57	3.05	2.58	3.01	2.60	3.03	2.61	4
5	3.83	3.21	3.82	3.23	3.80	3.25	3.79	3.26	5
6	4.60	3.36	4.58	3.88	4.56	3.90	4.55	3.92	6
7	5.36	4.50	5.34	4.52	5.32	4.55	5.30	4.57	7
8	6.13	5.14	6.11	5.17	6.08	5.20	6.06	5.22	8
9	6.89	5.79	6.87	5.82	6.84	5 85	6.82	5.87	9
10	7 66	6.43	7.63	6.46	7.60	6.49	7.58	6.53	10
11	8.43	7.07	8.40	7.11	8.36	7.14	8.33	7.18	11
12	9.19	7.71	9.16	7.75	9.12	7.79	9.09	7.83	12
13	9.96	8.36	9.92	8.40	9.89	8.44	9.85	8.49	13
14	10.72	9.00	10.69	9.05	10.65	9.09	10.61	9.14	14
15	11.49	9 64	11.45	9.69	11.41	9.74	11.36	9.79	15
16	12.26	10.28	12.21	10.34	12.17	10.39	12.12	10.44	16
17	13.02	10.93	12.97	10.98	12.93	11.04	12.88	11.10	17
18	13.79	11.57	13.74	11.63	13.69	11.69	13.64	11.75	18
19	14.55	12.21	14.50	12.28	14.45	12.34	14.39	12.40	19
20	15 32	12.86	15.26	12.92	15.21	12.99	15.15	13.06	20
21	16.09	13 50	16.03	13.57	15.97	13.64	15.91	13.71	21
22	16.85	14.14	16.79	14.21	16.73	14.29	16.67	14.36	22
23	17.62	14.78	17.55	14.86	17.49	14.94	17.42	15.01	23
24	18.38	15.43	18.32	15.51	18.25	15.59	18.18	15.67	24
25	19.15	16.07	19.08	16.15	19.01	16.24	18.94	16.32	25
26	19.92	16.71	19.84	16.80	19.77	16.89	19.70	16.97	26
27	20.68	17.36	20.61	17.45	20.53	17.54	20.45	17.62	27
28	21.45	18.00	21.37	18.09	21.29	18.18	21.21	18.28	28
29	22.22	18.64	22.13	18.74	22.05	18.83	21.97	18.93	29
30	22.98	19.28	22.90	19.38	22.81	19.48	22.73	19.58	30
31	23 75	19.93	23.66	20.03	23.57	20.13	23.48	20.24	31
32	24.51	20.57	24.42	20.68	24.33	20.78	24.24	20.89	32
33	25 28	21.21	25.19	21.32	25.09	21.43	25.00	21.54	33
34	26.05	21.85	25.95	21.97	25.85	22.08	25.76	22.19	34
35	26.81	22 50	26.71	22.61	26.61	22.73	26.51	22.85	35
36	27.58	23.14	27.48	23.26	27.37	23.38	27.27	23.50	36
37	28.34	23.78	28.24	23.91	28.14	24.03	28.03	24.15	37
38	29.11	24.43	29.00	24.55	28.90	24.68	28.79	24.80	38
39	29.88	25.07	29 77	25.20	29.66	25.33	29.54	25.46	39
40	30.64	25.71	30.53	25.84	30.42	25.98	30.30	26.11	40
41	31.41	26.35	31.29	26.49	31.18	26.63	31.06	26.76	41
42	32.17	27.00	32.06	27.14	31.94	27.28	31.82	27.42	42
43	32.94	27.64	32.82	27.78	32.70	27.93	32.58	28.07	43
44	33 71	28.28	33.58	28.43	33.46	28.58	33.33	28.72	44
45	34.47	28.93	34.35	29.08	34.22	29.23	34.09	29.37	45
46	35.24	29.57	35.11	29 72	34.98	29.87	34.85	30.03	46
47	36.00	30.21	35.87	30.37	35.74	30.52	35.61	30.68	47
48	36.77	30.85	36.64	31.01	36.50	31.17	36.36	31.33	48
49	37.54	31.50	37.40	31.66	37.26	31.82	37.12	31.99	49
50	37.30	32.14	38.16	32.31	38.02	32.47	38.88	32.64	50
Loa.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Loa.
	50 deg. 0 min.		49deg. 45 min.		49 deg. 30 min.		49 deg. 15 min.		

Loa.	41 deg. 0 min.		41 deg. 15 min.		41 deg. 30 min.		41 deg. 45 min.		Loa.
	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	
1	0.75	0.66	0.75	0.66	0.75	0.66	0.75	0.67	1
2	1.51	1.31	1.50	1.32	1.50	1.33	1.49	1.33	2
3	2.26	1.97	2.26	1.98	2.25	1.99	2.24	2.00	3
4	3.02	2.62	3.01	2.64	3.00	2 65	2.98	2.66	4
5	3 77	3.28	3.76	3.30	3.74	3.31	3.73	3.33	5
6	4.53	3.94	4.51	3.96	4.49	3 98	4.48	4.00	6
7	5.28	4.59	5.26	4.62	5.24	4.64	5.22	4 66	7
8	6.04	5.25	6.01	5.27	5.99	5.30	5.97	5.33	8
9	6.79	5.90	6.77	5.93	6.74	5.96	6.71	5.99	9
10	7.55	6.56	7.52	6.59	7.49	6.63	7.46	6.66	10
11	8.30	7.22	8.27	7.35	8.24	7.29	8.21	7.32	11
12	9.06	7.87	9.02	7.91	8.99	7.95	8.95	7.99	12
13	9.81	8.53	9.77	8.57	9.74	8.61	7.70	8.66	13
14	10.57	9.18	10.53	9.23	10.49	9.28	10.44	9.32	14
15	11.32	9.84	11 28	9.89	11.23	9.94	11.19	9.99	15
16	12.08	10.50	12.03	10.55	11.98	10.60	11.94	10.65	16
17	12.83	11.15	12.78	11.21	12.73	11.26	12.68	11.32	17
18	13.58	11.81	13.53	11.87	13.48	11.93	13.43	11.99	18
19	14.34	12.47	14.28	12.53	14.23	12.59	14 18	12.65	19
20	15.09	13.12	15.04	13.19	14.98	13.25	14.92	13.32	20
21	15.85	13.78	15.79	13.85	15.73	13.92	15 67	13.98	21
22	16 60	14 43	16.54	14.51	16.48	14.58	16.41	14.65	22
23	17.36	15.09	17.29	15.17	17.23	15.24	17.16	15.32	23
24	18.11	15.75	18.04	15.82	17.98	15.90	17.91	15.98	24
25	18.87	16.40	18.80	16.48	18.72	16.57	18.65	16 65	25
26	19.62	17.06	19.55	17.14	19.47	17.23	19.40	17.31	26
27	20.38	17.71	20.30	17.80	20.22	17.89	20.14	17.98	27
28	21.13	18 37	21.05	18.46	20.97	18.55	20.89	18.64	28
29	21.89	19.03	21.80	19.12	21.72	19.22	21.64	19.31	29
30	22.64	19.68	22.56	19.78	22.47	19.88	22.38	19 98	30
31	23.40	20.34	23.31	20.44	23.22	20.54	23.13	20 64	31
32	24.15	20.99	24.06	21.10	23.97	21.20	23.87	21.31	32
33	24.91	21.65	24.81	21.76	24.72	21.87	24.62	21.97	33
34	25.66	22.31	25.56	22.42	25.46	22.53	25.37	22.64	34
35	26.41	22.96	26.31	23.08	26.21	23.19	26.11	23.31	35
36	27.17	23.62	27.07	23.74	26.96	23.85	26.86	23.97	36
37	27.92	24.27	27.82	24.40	27.71	24.52	27.60	24.64	37
38	28.68	24.93	28.57	25.06	28.46	25.18	28.35	25.30	38
39	29.43	25.59	29.32	25.71	29.21	25.84	29.10	25.97	39
40	30.19	26.24	30.07	26.37	29.96	26.50	29.84	26.64	40
41	30.94	26.90	30.83	27.03	30.71	27.17	30.59	27.30	41
42	31.70	27.55	31.58	27.69	31.46	27.83	31.33	27.97	42
43	32 45	28.21	32.33	28.35	32.21	28.49	32.08	28.63	43
44	33.21	28.87	33.08	29.01	32.95	29.16	32.83	29.30	44
45	33.96	29.52	33.83	29.67	33.70	29.82	33.57	29.96	45
46	34.72	30.18	34.58	30.33	34.45	30.48	34.32	30.63	46
47	35.47	30.83	35.34	30.99	35 20	31 14	35.06	31.30	47
48	36.23	31.49	36.09	31.65	35.95	31.81	35.81	31.96	48
49	36.98	32.15	36.84	32.31	36.70	32.47	36.56	32.63	49
50	37.74	32.80	37.59	32.97	37.45	33.13	37.30	33 29	50
Loa.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Loa.
	49 deg. 0 min.		48 deg. 45 min.		48 deg. 30 min.		48 deg. 15 min.		

Loa.	42 deg. 0 min.		42 deg. 15 min.		42 deg. 30 min.		42 deg. 45 min.		Loa.
	Lat.	Lon.	Lat.	Lon.	a .	Lon.	Lat.	Lon.	
1	0.74	0.67	0.74	0.67	0.74	0.68	0.75	0.68	1
2	1.49	1.34	1.48	1.35	1.47	1.35	1.47	1.36	2
3	2.23	2.01	2.22	2.02	2.21	2.03	2.20	2.04	3
4	2.97	2.68	2.96	2.69	2.95	2.70	2.94	2.72	4
5	3.72	3.35	3.70	3.36	3.69	3.38	3.67	3.39	5
6	4.46	4.01	4.44	4.03	4.42	4.05	4.41	4.07	6
7	5.20	4.68	5.18	4.71	5.16	4.73	5.14	4.75	7
8	5.95	5.35	5.92	5.38	5.90	5.40	5.87	5.43	8
9	6.69	6.02	6.66	6.05	6.64	6.08	6.61	6.11	9
10	7.43	6.69	7.40	6.72	7.37	6.76	7.34	6.79	10
11	8.17	7.36	8.14	7.40	8.11	7.43	8.08	7.47	11
12	8.92	8.03	8.88	8.07	8.85	8.11	8.81	8.15	12
13	9.66	8.70	9.62	8.74	9 58	8.78	9.55	8.82	13
14	10.40	9.37	10.36	9.41	10.32	9.46	10.28	9.50	14
15	11.15	10.04	11.10	10.09	11.06	10.13	11.01	10.18	15
16	11.89	10.71	11.84	10.76	11.80	10.81	11.75	10.86	16
17	12.63	11.38	12.58	11.43	12.53	11.49	12.48	11.54	17
18	13.38	12.04	13.32	12.10	13.27	12.16	13.22	12.22	18
19	14.12	12.71	14.06	12.78	14.01	12.84	13.95	12.90	19
20	14.86	13.38	14.80	13.45	14 75	13.51	14.69	13.58	20
21	15.61	14.05	15.54	14.12	15.48	14.19	15.42	14.25	21
22	16.35	14.72	16.28	14.79	16.22	14.86	16.16	14.93	22
23	17.09	15.39	17.03	15.46	16.96	15.54	16.89	15.61	23
24	17.84	16.06	17.77	16.14	17.69	16.21	17.62	16.29	24
25	18 58	16.73	18.51	16.81	18.43	16.89	18.36	16.97	25
26	19.32	17.40	19.25	17.48	19.17	17.57	19.09	17.65	26
27	20.06	18.07	19.99	18.15	19.91	18.24	19.83	18.33	27
28	20.81	18.74	20.73	18.83	20.64	18.92	20.56	19.01	28
29	21.55	19.40	21.47	19.50	21.38	19.59	21.30	19.69	29
30	22.29	20.07	22.21	20.17	22.12	20.27	22.03	20.36	30
31	23.04	20.74	22.95	20.84	22.86	20.94	22.76	21.04	31
32	23.78	21.41	23.69	21.52	23.59	21.62	23.50	21.72	32
33	24.52	22.08	24.43	22.19	24.33	22.29	24.23	22.40	33
34	25.27	22.75	25.17	22.86	25.07	22.97	24.97	23.08	34
35	26.01	23.42	25.91	23.53	25.80	23.65	25.70	23.76	35
36	26.75	24.09	26.65	24.21	26.54	24.32	26.44	24.44	36
37	27.50	24.76	27.39	24.88	27.28	25.00	27.17	25.12	37
38	28.24	25.43	28.13	25.55	28.02	25.67	27.90	25.79	38
39	28.98	26.10	28.87	26.22	28.75	26.35	28.64	26.47	39
40	29.73	26.77	29.61	26.89	29.49	27.02	29.37	27.15	40
41	30.47	27.43	30.35	27.57	30.23	27.70	30.11	27.83	41
42	31.21	28.10	31.09	28.24	30.97	28.37	30.84	28.51	42
43	31.96	28.77	31.83	28.91	31.70	29.05	31.58	29.19	43
44	32.70	29.44	32.57	29.58	32.41	29.73	32.31	29.87	44
45	33.44	30.11	33.31	30.26	33.18	30.40	33.04	30.55	45
46	34.18	30.78	34 05	30.93	33.91	31.08	33.78	31.22	46
47	34.93	31.45	34.79	31.60	34.65	31.75	34.51	31.90	47
48	35.67	32.12	35.53	32.27	35.39	32.43	35.25	32.58	48
49	36.41	32.79	36.27	32.95	36.13	33.10	35.98	33.26	49
50	37.16	33.46	37.01	33.62	36.86	33.78	36.72	33.94	50
Lon.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.
	48 deg. 0 min.		47 deg. 45 min.		47 deg. 30 min		47 deg. 15 min.		

Loa.	43 deg. 0 min.		43 deg. 15 min.		43 deg. 30 min.		43 deg. 45 min.		Loa.
	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	
1	0.73	0.68	0.73	0.69	0.73	0.69	0.72	0.69	1
2	1.46	1.36	1.46	1.37	1.45	1.38	1.44	1.38	2
3	2.19	2.05	2.19	2.06	2.18	2.07	2.17	2.07	3
4	2.93	2.73	2.91	2.74	2.90	2.75	2.89	2.77	4
5	3.66	3.41	3.64	3.43	3.63	3.44	3.61	3.46	5
6	4.39	4.09	4.37	4.11	4.35	4.13	4.33	4.15	6
7	5.12	4.77	5.10	4.80	5.08	4.82	5.06	4.84	7
8	5.85	5.46	5.83	5.48	5.80	5.51	5.78	5.53	8
9	6.58	6.14	6.56	6.17	6.53	6.20	6.50	6.22	9
10	7.31	6.82	7.28	6.85	7.25	6.88	7.22	6.92	10
11	8.04	7.50	8.01	7.54	7.98	7.57	7.95	7.61	11
12	8.78	8.18	8.74	8.82	8.70	8.26	8.67	8.30	12
13	9.51	8.87	9.47	8.91	9.43	8.95	9.39	8.99	13
14	10.24	9.55	10.20	9.59	10.16	9.64	10.11	9.68	14
15	10.97	10.23	10.93	10.28	10.88	10.33	10.84	10 37	15
16	11.70	10.91	11.65	10.96	11.61	11.01	11.56	11.06	16
17	12.43	11.59	12.38	11.65	12.33	11.70	12.28	11.76	17
18	13.16	12.28	13.11	12.33	13.06	12.39	13.00	12.45	18
19	13.90	12.96	13.84	13.02	13.78	13.08	13.72	13.14	19
20	14.63	13.64	14.57	13.70	14.51	13.77	14.45	13.83	20
21	15.36	14.32	15.30	14.39	15.23	14.46	15.17	14.52	21
22	16.09	15.00	16.02	15.07	15.96	15.14	15.89	15.21	22
23	16.82	15.69	16.75	15.76	16.68	15.83	16.61	15.90	23
24	17.55	16.37	17.48	16.44	17.41	16.52	17.34	16.60	24
25	18.28	17.05	18.21	17.13	18.13	17.21	18.06	17.29	25
26	19.02	17.73	18.94	17.81	18.86	17.90	18.78	17.98	26
27	19.75	18.41	19.67	18.50	19.58	18.59	19.50	18.67	27
28	20.48	19.10	20.39	19.19	20.31	19.27	20.23	19.36	28
29	21.21	19.78	21.12	19.87	21.04	19.96	20 95	20.05	29
30	21.94	20.46	21.85	20.56	21.76	20.65	21.67	20.75	30
31	22.67	21.14	22.58	21.24	22.49	21.34	22.39	21.44	31
32	23.40	21.82	23.31	21.93	23.21	22.03	23.12	22.13	32
33	24.13	22.51	24.04	22.61	23.94	22.72	23.84	22.82	33
34	24.87	26.19	24.76	23.30	24.66	23.40	24.56	23.51	34
35	25.60	23.87	25.49	23.98	25.39	24.09	25.28	24.20	35
36	26.33	24.55	26.22	24.67	26.11	24.78	26.00	24.89	36
37	27.06	25.23	26.95	25.35	26.84	25.47	26.73	25.59	37
38	27.79	25.92	27.68	26.04	27.56	26.16	27.45	26.28	38
39	28.52	26.60	28.41	26.72	28.29	26.85	28.17	26.97	39
40	29.25	27.28	29.13	27.41	29.01	27.53	28.89	27.66	40
41	29.99	27.96	29.86	28.09	29.74	28.22	29.62	28.35	41
42	30.72	28.64	30.59	28.78	30.47	28.91	30.34	29.04	42
43	31.45	29.33	31.32	29.46	31.19	29.60	31.06	29.73	43
44	32.18	30.01	32.05	30.15	31.92	30.29	31.78	30.43	44
45	32.91	30.69	32.78	30.83	32.64	30 98	32.51	31.12	45
46	33.64	31 37	33.51	31.52	33.37	31.66	33.23	31.81	46
47	34.37	32.05	34.23	32.20	34.09	32.35	33.95	32.50	47
48	35 10	32.74	34.96	32.89	34.82	33.04	34.67	33.19	48
49	35.84	33.42	35.69	33.57	35.54	33.73	35.40	33.88	49
50	36.57	34.10	36 42	34.26	36.27	34.42	36.12	34.58	50
Loa.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Loa.
	47 deg. 0 min.		46 deg. 45 min.		46 deg. 30 min.		46 deg. 15 min.		

Loa.	44 deg. 0 min.		44 deg. 15 min.		44 deg. 30 min.		44 deg. 45 min.		45 deg.	Loa.
	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	
1	0.72	0.69	0.72	0.70	0.71	0.70	0.71	0.70	0.71	1
2	1.44	1.39	1.43	1.40	1.43	1.40	1.42	1.41	1.41	2
3	2.16	2.08	2.15	2.09	2.14	2.10	2.13	2.11	2.12	3
4	2.88	2.78	2.87	2.79	2.85	2.80	2.84	2.82	2.83	4
5	3.60	3.47	3.58	3.49	3.57	3.50	3.55	3.52	3.54	5
6	4.32	4.17	4.30	4.19	4.28	4.21	4.26	4.22	4.24	6
7	5.04	4.86	5.01	4.88	4.99	4.91	4.97	4.93	4.95	7
8	5.75	5.56	5.73	5.58	5.71	5.61	5.68	5.63	5.66	8
9	6.47	6.25	6.45	6.28	6.42	6.31	6.39	6.34	6.36	9
10	7.19	6.95	7.16	6.98	7.13	7.01	7.10	7.04	7.07	10
11	7.91	7.64	7.88	7.68	7.85	7.71	7.81	7.74	7.78	11
12	8.63	8.34	8.60	8.37	8.56	8.41	8.52	8.45	8.48	12
13	9.35	9.03	9.31	9.07	9.27	9.11	9.23	9.15	9.19	13
14	10.07	9.73	10.03	9.77	9.99	9.81	9.94	9.86	9.90	14
15	10.79	10.42	10.74	10.47	10.70	10.51	10.65	10.56	10.61	15
16	11.51	11.11	11.46	11.16	11.41	11.21	11.36	11.26	11.31	16
17	12.23	11.81	12.18	11.86	12.13	11.92	12.07	11.97	12.02	17
18	12.95	12.50	12.89	12.56	12.84	12.62	12.78	12.67	12.73	18
19	13.67	13.20	13.61	13.26	13.55	13.32	13.49	13.38	13.44	19
20	14.39	13.89	14.33	13.96	14.26	14.02	14.20	14.08	14.14	20
21	15.11	14.59	15.04	14.65	14.98	14.72	14.91	14.78	14.85	21
22	15.83	15.28	15.76	15.35	15.69	15.42	15.62	15.49	15.56	22
23	16 54	15.98	16.47	16.05	16.40	16.12	16.33	16.19	16.26	23
24	17.26	16.67	17.19	16.75	17.12	16.82	17.04	16.90	16.97	24
25	17.98	17.37	17.91	17.44	17.83	17.52	17.75	17.60	17.68	25
26	18.70	18.06	18.62	18.14	18.54	18.22	18.46	18.30	18.38	26
27	19.42	18.76	19.34	18.84	19.26	18.92	19.18	19.01	19.09	27
28	20.14	19.45	20.06	19.54	19.97	19.63	19.89	19.71	19.80	28
29	20.86	20.15	20.77	20.24	20.68	20.33	20.60	20.42	20.51	29
30	21.58	20.84	21.49	20.93	21.40	21.03	21.31	21.12	21.21	30
31	22.30	21.53	22.21	21.63	22.11	21.73	22.02	21.82	21.92	31
32	23.02	22.23	22.92	22.33	22.82	22.43	22.73	22.53	22.63	32
33	23.74	22.92	23.64	23.03	23.54	23.13	23.44	23.23	23.33	33
34	24.46	23.62	24.35	23.72	24.25	23.83	24.15	23.94	24.04	34
35	25.18	24.31	25.07	24.42	24.96	24.53	24.86	24.64	24.75	35
36	25.90	25.01	25.79	25.12	25.68	25.23	25.57	25.34	24.46	36
37	26.62	25.70	26.50	25.82	26.39	25.93	26.28	26.05	26.16	37
38	27.33	26.40	27.22	26.52	27.10	26.63	26.99	26.75	26.87	38
39	28.05	27.09	27.94	27.21	27.82	27.34	27.70	27.46	27.58	39
40	28.77	27.79	28.65	27.91	28.53	28.04	28.41	28.16	28.28	40
41	29.49	28.48	29.37	28.61	29.24	28.74	29.12	28.86	28.99	41
42	30.21	29.18	30.08	29.31	29.96	29.44	29.83	29.57	29.70	42
43	30.93	29.87	30.80	30.00	30.67	30.14	30.54	30.27	30.41	43
44	31.65	30.57	31.52	30.70	31.38	30.84	31.25	30.98	31.11	44
45	32.37	31.26	32.23	31.40	32.10	31.54	31.96	31.68	31.82	45
46	33.09	31.95	32.95	32.10	32.81	32.24	32.67	32.38	32.53	46
47	33.81	32.65	33.67	32.80	33.52	32.94	33.38	33.09	33.23	47
48	34.53	33.34	34.38	33.49	34.24	33.64	34.09	33.79	33.94	48
49	35.25	34.04	35.10	34.19	34.95	34.34	34.80	34.50	34.65	49
50	35.97	34.73	35.82	34.89	35.66	35.05	75.51	35.20	35.36	50
Loa.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	Loa.
	46 deg.	0 min.	45 deg.	45 min.	45 deg.	30 min.	45 deg.	15 min.	45 deg.	

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